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ROBBINS (W. J.) & MA (ROBERTA). **Pseudopyridoxine and certain fungi.**—*Proc. nat. Acad. Sci., Wash.*, xxix, 6, pp. 172–176, 1943.

Continuing their earlier studies [*R.A.M.*, xxii, p. 218], the authors found that *Ophiostoma catonianum*, *Ceratostomella ips* No. 255, *C. montium*, *C. microspora*, *C. multiannulata*, *C. piliferum*, *C. pluriannulata*, and *C. ulmi* responded to pyridoxin as such. The physiological activity of pyridoxin was not replaced by *dl*-alanine. No evidence was obtained from these fungi of the existence of E. E. Snell's more active pseudopyridoxin.

SAMSON (R. W.) & ELLIS (N. K.). **Influence of time of planting of Potatoes in Indiana muck soil on yield and scab development.**—*Amer. Potato J.*, xx, 12, pp. 301–308, 1943.

From 1939 to 1942 the yields of Katahdin, Irish Cobbler, and Sebago potatoes, both total and marketable (in respect of freedom from scab [*Actinomyces scabies*]), were calculated for crops from plantings made at five fortnightly intervals from 5th May to 5th July on a muck soil farm near Walkerton, Indiana.

Total yields decreased with each successively later planting, whereas scab severity rose to a maximum in the third or fourth, except in 1942, when it decreased in the last planting. Thus, the average total yields over the entire period of the tests for the 5th to 6th and 19th to 21st May, 2nd to 5th and 16th to 20th June, and 30th June to 5th July were 365, 327, 261, 170, and 76 bush., respectively, the percentages of marketable tubers for the corresponding dates being 61, 45, 36, 42, and 40, respectively. The incidence of the pitted and superficial types of the disease [*R.A.M.*, xix, p. 111] on Cobblers planted on 22nd May and 6th and 23rd June, 1940, was 11, 15, and 24, and 43, 51, and 53 per cent., respectively.

Further work is in progress to elucidate the factors responsible for variations in the incidence of scab in relation to variety and planting dates under local conditions. Soil moisture is probably of outstanding importance in this connexion, influencing as it does both yield and scab development. In the meantime, planting at the earliest feasible date is evidently one method of reducing the losses from *A. scabies* in the three varieties under observation.

HORSFALL (J. G.) & TURNER (N.). **Injuriousness of Bordeaux mixture.**—*Amer. Potato J.*, xx, 12, pp. 308–320, 2 graphs, 1943.

Bordeaux mixture has been known for some time to reduce potato yields in the absence of pests and diseases [*R.A.M.*, ix, p. 265], and in the present series of tests at the Connecticut Agricultural Station the compound was shown to exert a similar adverse effect on production even in the case of serious depredations by the flea-beetle [*Epitrix cucumeris*]. Hitherto such damage has been masked by the control of the particular pest or disease under investigation, but the writers obviated this difficulty by the application of a method for the separation of the two mutually exclusive effects when operating on the same plots. The method [which is fully described] involves the determination of the graphic relation of

pest or disease attack to yield, and the assessment, by interpolation on parallel curves, of the treated and control plots at equal levels of insect or disease incidence. Using this technique, the yield reductions from Bordeaux spraying at median levels of attack were fixed at roughly 12 and 11 per cent. for flea-beetles on Irish Cobbler and tipburn on Green Mountain, respectively.

It is not proposed that Bordeaux should be discarded, particularly at the present critical juncture, on account of its injurious action on productivity, which may be mitigated by the following precautions: spraying as seldom and starting as late in the season as possible, use of a 'low-strength' formula, e.g., 300 gals. 2-1-50 per acre instead of 100 gals. 8-4-50; and the substitution of dolomitic (magnesium) for high-calcium lime [ibid., xiii, p. 725; xiv, p. 607].

Godoy (E. F.). **Epifitología del 'tizón' de la Papa en la zona papera 'sudeste' de la Provincia de Buenos Aires durante el verano 1940–41.** [Epiphytology of Potato 'blight' in the 'south-eastern' Potato-growing zone of the Province of Buenos Aires during the summer of 1940–41.]—*Rev. Fac. Agron., La Plata*, Ser. 3, xxv (*1940*), pp. 97–139, 3 pl., 2 graphs, 2 maps, 1943. [English summary.]

An outbreak of late blight (*Phytophthora infestans*) of unprecedented severity occurred in 1940–1 throughout the potato-growing region south-east of the Province of Buenos Aires, originating in the coastal districts. The attacks developed at intervals of a few days from 24th December to 24th February and varied in intensity, in some places actually destroying the crops, while in others they assumed a milder form but constituted a permanent focus of inoculum during the season. The source of infection could not be definitely traced, since both local and foreign 'seed' was used for planting.

Analyses of rainfall, incidence of dew and fog, relative humidity, and cloudiness for the period covered by the epiphytotic showed that the conditions laid down by workers in other countries for the intensive development of the pathogen [*R.A.M.*, xiv, p. 715 *et passim*] were amply fulfilled. The so-called 'fog strokes' and 'sunstrokes' are also believed to be forms of potato blight. During the last 33 years there were four authenticated cases and two unconfirmed reports of late blight in the south-eastern zone, the season of 1914–15 having been characterized by an epidemic of comparable severity to the one under discussion. In the 'blight' seasons, the precipitation from December to March was above the normal for the 33-year period, while the rainfall for each month in which the disease was recorded also exceeded the average. The relative humidity during the same seasons was abnormally high, and the summers marked by severe outbreaks were exceptionally cool, the minimum temperature of 16·4° C. having been registered in 1940–1.

The tubers of the Katahdin, Green Mountain, and White Rose varieties were equally susceptible to infection by *P. infestans*, while the foliage of the first-named was more resistant than that of the other two, and the leaves of the European Alma and Arran Consul sustained less severe damage than those of the above-mentioned American sorts. It is estimated that 60 to 70 per cent. of the potential yield was lost through late blight in 1940–1, and the results of spraying experiments with Bordeaux mixture indicated that the control by this means of such a virulent epidemic is difficult, if not impossible.

Small (T.). **The soil as a source of infection of dry rot of Potato.**—*Nature, Lond.*, cliii, 3884, pp. 436–437, 1944.

In 1942, inoculation of susceptible varieties of potato tubers with unsterilized field soil previously sprayed with a spore suspension of *Fusarium coeruleum* caused dry rot development. In the same year and in 1943, soil samples were obtained

from several farms in Cheshire, each consisting of soil scraped from 30 tubers with a sterile knife and placed in a new envelope in the field at digging time, before the tubers contacted any possible source of infection. All the samples were tested by direct inoculation of tubers and found to be infected. Similar results were obtained with many samples collected at random from healthy seed tubers stored in seed boxes in lofts during the winter of 1942–3.

During the winter of 1943–4, soil samples were collected at wholesale stores from seed potatoes imported from Scotland and Northern Ireland. Of 42 such samples tested, 37 were infected. The *Fusarium* species isolated in all this work were not identified, but all produced dry rot on test tubers.

These results prove that the organism or organisms causing potato dry rot are present in field soils in Cheshire and in the soil adhering to imported seed tubers before these are distributed to farmers.

Brown spot of Paddy.—*Trop. Agriculturist*, xcix, 3, pp. 150–151, 1 pl., 1943.

Rice brown spot (*Helminthosporium oryzae*) [*Ophiobolus miyabeanus*: *R.A.M.*, xxi, p. 362] has been present in Ceylon for about 23 years, where, however, it has not hitherto been recorded as causing serious damage. In June and July, 1943, infection reached epidemic proportions in the Uva district, where the 'four-months' varieties Hondarawela, Suduwi, Karayal, Rathkunda, Samba, Perillanel, and Vellai illankalayan were all equally affected. Transplanted rice was more resistant than broadcast sowings. The outbreak appears to have been favoured by wet, humid weather, the presence of sufficient inoculum, and poor growth of the plants.

Seed from affected heads should not be used for sowing. After harvesting, the stubble and chaff should be burnt on the fields. Intensive cultivation of the affected fields is recommended, together with a thorough clearing-up of all weeds and grass. Transplanting should be practised wherever possible.

Wahlin (B.). **Några fall av manganbrist sommaren 1943**. [Some cases of manganese deficiency in the summer of 1943.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, viii, 1, pp. 11–15, 2 figs., 1944.

Hemp on a reclaimed marshland farm in Gothland, Sweden, was observed towards the end of May, 1943, to show signs of manganese deficiency, including arrested growth (20 to 30 instead of 60 cm. in height) and the development on the leaves, beginning with the basal ones, of brown, necrotic spots, which expanded and finally, in conjunction with a spell of dry weather, destroyed the plants. On 11th June a portion of the field was divided into three and treated with (1) manganese sulphate at the rate of 40 kg. per ha., (2) the same plus saltpetre, 100 kg. per ha., and (3) the latter alone. On the 13th 4 mm. of rain fell, and within the next few days a noticeable improvement took place in the condition of the manganese sulphate-treated sections of the field, whereas deficiency symptoms were still apparent on the part receiving saltpetre. Manganese deficiency also affected another hemp crop on a larger field of the same farm, and in this case the adjoining spring wheat [*R.A.M.*, xxiii, p. 129] and white mustard stands were similarly involved. The height of the wheat plants was reduced from 50 to 30 or even 20 cm. in cases of acute shortage, the lower leaves were wilted or dead and the upper ones mottled yellow-green, with necrotic tips. The lack of manganese in the mustard crop was chiefly expressed by partial failure of growth, accompanied in some of the plants by yellow spotting of the foliage. Manganese sulphate was applied with the same beneficial effects as in the smaller hemp crop. The P_H values of the larger field were determined and found to be 5·9 and 6·4 at distances of 30 and 15 m., respectively, from the dyke and 7·4 along the latter, corresponding to acute and moderate shortages and a sufficiency of manganese, respectively.

Dennis (A. C.) & Dennis (R. W. G.). **Boron and plant life—part V. Developments in agriculture and horticulture, 1940–42.**—Reprinted (with addition of bibliography) from *Fertil. Feed. St. J.*, 38 pp., 5 figs., 1 graph, 1943.

In continuation of their earlier work on the subject [*R.A.M.*, xx, p. 322], the authors review 186 papers dealing with boron in relation to plant life published during the years 1940 to 1942.

Ferres (H. M.) & Trumble (H. C.). **Exploratory investigations of soil deficiencies by means of small pot cultures.**—*J. Aust. Inst. agric. Sci.*, ix, 4, pp. 179–182, 2 figs., 1943.

In view of the frequent failures of pasture in the high rainfall areas of South Australia, and the accumulating evidence of response to manganese, copper, zinc, boron, and molybdenum, the authors carried out pot culture tests in 1942 as a preliminary means of investigating large numbers of soils simultaneously under comparable conditions of technical control. Subterranean clover was used as the test plant from March to September and Palestine strawberry clover [*Trifolium fragiferum*] in summer. When evidence had been secured of response to one or more groups of the elements, further tests were conducted to separate the effects of single elements and their interactions. The data obtained are tabulated. The chief value of the method is the rapidity with which a lead is obtained for subsequent field tests.

Marchionatto (J. B.). **La contribución de Carlos Spegazzini a la fitopatología argentina.** [The contribution of Carlos Spegazzini to Argentine phytopathology.]—*Rev. Fac. Agron., La Plata*, Ser. 3, xxv (*1940*), pp. 11–20, 1 fig., 1943.

Spegazzini's numerous contributions to the study of mycology and phytopathology in Argentina are listed, with the addition of critical notes and bibliographical citations.

Gottlieb (D.). **The mechanism of wilting caused by Fusarium bulbigenum var. lycopersici.**—*Phytopathology*, xxxiv, 1, pp. 41–59, 1 fig., 1 diag., 1944.

A dense mycelial growth of *Fusarium bulbigenum* var. *lycopersici* was observed in about half the vessels in the roots and lower stems of wilted tomato plants, but no isolations could be made from the tops of the stems. The wilting of the plants is correlated with the presence of a toxin [*R.A.M.*, xxii, p. 330] in the tracheal fluid. The poisonous substance withstands oxidation, and spectrographic analyses revealed no important differences between the emission-element contents of fluids from diseased and healthy plants. On immersion in distilled water, the wilted plants recover, but loss of turgidity again ensues on their transference to toxic fluids. The toxin interferes with the normal water relations of the host. When the transpiration of seedlings immersed in the toxic tracheal fluids is prevented, wilting does not occur, while seedlings that have already become flaccid regain their turgidity under these conditions.

Swingle (R. U.), Tilford (P. E.), & Irish (C. F.). **A graft transmissible mosaic of American Elm.**—*Phytopathology*, xxxiii, 12, pp. 1196–1200, 3 figs., 1943.

Further inoculation experiments in 1940 and 1941 at Wooster, Ohio, involving the grafting of over 100 healthy American elms with branch, trunk, and root materials from mosaic-diseased trees in the same State, Kentucky, and New Jersey, confirmed previous observations as to the transmissibility of the disorder by this means [*R.A.M.*, xx, p. 237]. The symptomatology of the condition and its communicability to sound trees by the introduction of mosaic patches suggest the agency of a virus, the mode of spread of which in the field is unknown. Attempts

to improve the state of the elms by the application of a fertilizer and the excision of diseased branches have been unsuccessful.

WEBER (G. F.). **Needle rusts of Pine trees in Florida caused by Coleosporium species.**—*Proc. Fla Acad. Sci.*, vi, 3–4, pp. 131–142, 1943.

Needle rusts (*Coleosporium* spp.) have been collected in widely separated localities of Florida over a period of nearly 20 years, and the writer suspects them to be co-extensive with their pine hosts [*R.A.M.*, xix, p. 126]. All the rusts are heteroecious, the pycnidial and aecidial stages being formed on *Pinus* spp. and the uredo and teleuto phases on herbaceous plants, mostly broad-leaved members of the Carduaceae. The ten species of *Coleosporium* investigated were distributed as follows: *C. apocynaceum* on *P. australis*, *P. palustris*, and *P. taeda*, with *Amsonia ciliata* as the alternate host; *C. delicatulum* on the same *P.* spp. and *P. serotina* (*Euthamnia caroliniana*, *E. leptocephala*, and *E. minor*); *C. elephantopodis* on the above-mentioned pines and *P. glabra* (*Elephantopus carolinianus*, *E. elatus*, *E. nudatus*, and *E. tomentosus*); *C. heterothecae* on *P. australis* (*Heterotheca subaxillaris*); *C. ipomoeae* on *P. australis*, *P. palustris*, *P. serotina*, and *P. taeda* (*Colonyction aculeatum*, *Ipomoea carolina*, *I. pandurata*, *I. pes-capreae*, *I. speciosa*, *I. triloba*, *Pharbitis barbegina*, *P. cathartica*, and *P. hederacea*); *Coleosporium laciniariae* on *Pinus australis* (*Laciniaria chapmanii*, *L. elegans*, *L. graberi*, *L. gracilis*, *L. laxa*, *L. pilosa*, *L. scariosa*, and *L. tenuifolia*) [*Liatris* spp.]; *C. minutum* on *P. glabra* and *P. taeda* (*Adelia ligustrina*); *C. solidaginis* does not attack pines in Florida, but is found on *Aster puniceus*, *Chrysopsis scabrella*, *Solidago brachyphylla*, *S. chapmani*, *S. fistulosa*, *S. puberula*, *S. rugosa*, *S. sempervirens*, and *S. stricta*; *C. vernoniae* on all the above-mentioned pines, *P. clausa*, and *P. echinata*; and *C. viguierae*, absent from pines but infecting *Verbesina laciniata*.

The rusts have been observed to cause very heavy damage to seedlings up to 3 ft. in height, but are seldom of importance on saplings or trees. The principal symptom of infection is the appearance of yellow to orange-coloured areas, up to several centimetres in length, on any part of the needle between the fascicle sheath and the tip. The pycnidia may be seen in central Florida any time after early January, being most abundant during the latter half of February. The circular to oval, slightly raised, rounded, smooth, reddish-orange to black structures, 1 to 4 mm. in diameter, develop in single, continuous or intermittent, irregular lines, in several parallel short lines, or in irregular clusters on the yellowish areas, usually all on one side of the needle. Three to six weeks later the aecidia rupture the leaf epidermis opposite the pycnidia. The aecidiospores within the peridial walls are bright orange. On the alternate hosts the symptoms are much less conspicuous, consisting merely of yellow cushion-like areas on the leaves, which may, however, destroy the plants.

The infected herbaceous hosts are the source of summer and autumn inoculum for the pines, and conversely, the aecidial spores from the latter serve to infect the former in the spring. The aecidiospores are very resistant to adverse conditions, travelling long distances without loss of viability, in contrast to the short-lived basidiospores, which usually die within a mile of their original host. The herbaceous hosts are in all cases directly penetrated by the spore tubes, which grow through the epidermis, whereas entry to the pine needles appears to be effected through the stomata. The aecidia appear in the spring following the previous season's infection, usually scattered, though Spaulding (*Phytopathology*, vii, p. 225, 1917) found up to 20 per needle. Less than a month later uredosori develop on the alternate hosts. Invasion of the tissues is not usually extensive, and consequently the yellow areas on the needles are circumscribed.

In order to avoid contact with the alternate hosts of the rusts, pine seed-beds should be located in cultivated sites at a distance from woodlands, roadsides, and

fence rows where the weeds abound. A copper-containing fungicide may be applied to transplanted seedlings where ornamental values are an important consideration.

Reference is made to previous outstanding contributions to the study of *C.* spp., and a revised and abridged version of the portion of Hedgcock's key [*R.A.M.*, vii, p. 603] applicable to Florida is presented. The morphology of the rusts is described.

LEUTRITZ (J.). **Outdoor tests of wood preservatives.**—*Bell Lab. Rec.*, xxii, 4, pp. 179–182, 2 figs., 1943.

Outdoor tests of wood preservatives are now carried out by the Bell Telephone Laboratories as follows. Sticks $\frac{3}{4}$ in. square and 3 ft. long are cut from boards of southern pine sapwood and classified according to density, and for a single treatment with a given concentration specimens are selected which are uniformly distributed throughout a chosen density range. For the full-cell treatment, the specimens are placed in a cylinder, from which the air is then evacuated and after a specified time the preservative is poured in and forced by air pressure into the wood cells. By this procedure about 30 lb. of the disinfectant may be injected per cu. ft. For lower retentions the preservative may be treated with a volatile solvent which evaporates rapidly as soon as the process is completed. For the empty-cell treatment, the pressure of the cylinder is raised from atmospheric to between 25 and 50 lb. The preservative is then pumped in and forced into the wood by a further rise in pressure. On the release of this pressure, the expansion of the initial air entrapped by the preservative forces out the excess from the wood, and theoretically only the cell wall is coated—hence the name, empty-cell treatment. Vacuum is also applied after the release of pressure to empty the cells more thoroughly.

Twenty to 25 sticks are selected for each single charge and laid side by side. They are marked with crayon 7 in. from each end, at the mid-point, and 2 in. on either side of it. Identification tags are affixed and the sample is weighed before and after treatment, the gain on the latter occasion being taken as the basis for calculating the amount of preservative retained. The sticks are then cut at the mid-point line, thus providing specimens treated under identical conditions for comparison by the laboratory rot test (*Bell Lab. Rec.*, p. 324, May, 1938) and field exposures. Some of the latter tests are conducted in New Jersey, but the bulk of the specimens are exposed at Gulfport, Mississippi, where climatic conditions ensure severe rotting practically all the year round. The specimens are buried (usually in the spring) to the 7-in. mark in a uniform distribution throughout the plot. Once a year they are examined and the incidence of decay at and below soil-level rated. Ten denotes a sound condition, while 0 is allotted to the sticks so entirely disintegrated as to be found lying on the ground. The intermediate ratings are used to express the relative amounts of decay or termite infestation, 5 being the critical point at which the specimen can easily be broken in the hands, indicating failure of the particular treatment under investigation.

Since some specimens survive for several years or withstand the exposure tests, a time rating was devised taking their past performance into consideration. At the end of each year's exposure, the average rating for that year of a group of specimens is computed and multiplied by the number of years the sticks have been exposed at that time. After several years of testing, the sum of these products is taken and divided by the sum of the years of exposure. For instance, if the average rating of a group is 9·5 after one years' exposure and 8·3 after two years, the time rating would be $2(9{\cdot}5+8{\cdot}3)$ divided by $(1+2)$.

Preservatives showing promise in laboratory and field tests with small specimens are applied to larger pieces of fence-post size, known as 'stobs', and in the event of favourable results, an experiment on a commercial scale may be warranted

with pole-size timber. For this purpose, 10-ft. posts are cut from poles and exposed in test gardens, where valuable information is obtained on the retention of the preservative by the wood when heated by the sun or leached by ground waters.

Data provided by these accelerated outdoor exposure tests have been of considerable use in the evaluation of both oil- and salt-type preservatives. Perhaps the most encouraging results were obtained with greensalt [*R.A.M.*, xxii, p. 47], which has been used on a limited scale in place of creosote where clean, full-length treated poles were required. Owing to the emergency restrictions now in force on the use of many of the metallic salts, the results of the studies on most preparations of this type cannot be immediately applied.

Fox Wilson (G.) & Green (D. E.). **A simple calendar of control measures against vegetable pests and diseases.**—*J.R. hort. Soc.*, lxix, 4, pp. 104–111, 1944.

The symptoms of some well-known vegetable pests and diseases likely to concern allotment-holders, with appropriate preventive and curative measures for each, are presented in tabular form.

Jones (W.). **Downy mildew disease of Cauliflower seed plants.**—*Sci. Agric.*, xxiv, 6, pp. 282–284, 1 fig., 1944.

Numerous cauliflower plants of the Snowball variety, growing in British Columbia, recently became almost worthless for seed production owing to infection of the curd by *Peronospora brassicae* [*P. parasitica*]. Infection of seedlings in cold frames and of the foliage of plants grown in the field has been observed in many localities, but in 1943 a systemic type of infection, involving the main stems and the curd, occurred in many plants; most of the curd parts were stunted, having failed to elongate into normal inflorescences. A constant symptom was a dark purple discoloration of the surface of the stems of the curd, which often appeared in broad longitudinal streaks. Affected tissues were somewhat shrunken and conidiophores and conidia were generally present on the infected stems and leaflets. The internal tissues showed dark grey, necrotic spots and areas, which were present in the main stems as well as in the stems of the curd. In the Pacific Coast areas of British Columbia, where cauliflowers are grown for seed, losses due to curd rot caused by various factors are often very considerable. The trouble usually occurs when the curd is well developed, but before the floral parts start to elongate.

An experiment was carried out in which small cauliflowers were inoculated out-of-doors in October by placing on the surface and among the inner parts of the curd cabbage leaves bearing conidia. After about three weeks, the surface of the curd assumed a dirty white to brown colour, while the surface and internal tissues of the curd stems were dark purple and dark grey, respectively. The mycelium was found in the terminal tissues and in the stems of the curd. About six weeks after inoculation, the infected end was shrivelled, stunted, and brown, though the curd of the control plants was white, firm, and normal.

It is recommended that cauliflower seedlings should be sprayed in the seed-bed with Bordeaux mixture to which a spreader and sticker, such as calcium caseinate, has been added. Spraying should begin as soon as the first leaves start to develop. Other cruciferous hosts should also be sprayed, or eradicated. If the disease should appear on cauliflower seed plants in the field during the curd stage, they should be dusted with copper-lime dust every 10 days until the floral parts are well developed. Insect pests, some of which act as spore-carriers, must also be checked.

Bennett (C. W.). **Latent virus of Dodder and its effect on Sugar Beet and other plants.**—*Phytopathology*, xxxiv, 1, pp. 77–91, 7 figs., 1944.

Dodder (*Cuscuta californica*), removed from plants of the desert shrub, *Eriogonum fasciculatum*, near Riverside, California, and placed on healthy sugar beets in a

greenhouse at the Citrus Experiment Station, was found to harbour a hitherto unknown virus which induced mottling or necrosis, or both, on sugar beet, Rocky-ford cantaloupe, White Rose potato, tomato, Early Self Blanching celery, buck-wheat, pokeweed (*Phytolacca americana*) [*P. decandra*], *Samolus floribundus*, *Polygonum pennsylvanicum*, *Plantago major*, *Chenopodium murale*, *C. album*, and *Nicotiana palmeri* (temporary vein-clearing only on the last-named). By the use of virus-free dodder, the infective principle was recovered from the following symptomless species: *N. glauca*, *N. rustica* vars. English, Iowa, *pumila*, and *jamaicensis*, Turkish tobacco, and mustard (*Brassica incana*).

No insect vector of the dodder virus is known, but transmission is effected by *Cuscuta californica*, *C. subinclusa*, and *C. campestris*. It is readily conveyed by juice inoculation to *Phytolacca decandra*, on which numerous primary lesions are produced, and with more difficulty to *C. campestris*, *Chenopodium murale*, and sugar beet. In the case of *Cuscuta campestris*, seed transmission occurred to the extent of just under 5 per cent.

The thermal inactivation point of the virus, for which the common and Latin names of dodder latent mosaic virus and *Marmor secretum* n.sp., respectively, are suggested, lies between 56° and 60° C. *P. decandra* juice was infectious at a dilution of 1 in 3,000, the activity of the virus in this medium being lost, however, in 48 hours, and in a shorter period in dried juice, while the dried parts of diseased plants yielded no virus. The passage of the virus through Berkefeld N and W filters was readily accomplished.

Although the dodder virus has not been observed to occur on any crop plant in the field, its destructive potentialities, given the introduction of an efficient vector, should not be disregarded, especially in the cases of cantaloupe and buckwheat, and to a lesser extent, in those of sugar beet, potato, and celery.

MARKHAM (R.). **The isolation of viruses by means of the electrically driven Sharples supercentrifuge.**—*Parasitology*, xxxv, 4, pp. 173–177, 1 graph, 1944.

A method of virus isolation by means of an electrically driven Sharples centrifuge is fully described. It has been used for the sedimentation of tobacco mosaic, tomato bushy stunt, tobacco necrosis, and the recently detected virus on *Atropa belladonna* [*R.A.M.*, xxii, p. 451], and infectivity tests showed that the bulk of the viruses is recovered from the sap of frozen leaves, clarified with disodium phosphate, after three-hour spins.

Report of the Waite Agricultural Research Institute, South Australia, 1941–1942.—84 pp., 2 pl., 1 map, 1943.

Items of phytopathological interest in this report [cf. *R.A.M.*, xxi, p. 124], besides those already noticed from other sources, include the following. The severe and widespread epidemic of wheat stem rust (*Puccinia graminis tritici*, race 34) [*R.A.M.*, xxiii, p. 95] in the abnormally wet season of 1941 was responsible for an estimated loss of 10,000,000 bush. in South Australia. In common with other susceptible varieties, Seewari was badly rusted in 1941, but in 1942 it yielded consistently well in several localities. Two strains of Nabawa × (Riverina × Hope), (38–356) and (39–129), were found to compare very favourably with Warigo [loc. cit.] in country trials in 1942. Both are resistant to stem rust, leaf rust [*P. triticina*], and flag smut (*Urocystis tritici*). Stem rust-resistant crossbreds derived from Kenya C6042 and C6040 were included in replicated experiments in 1941 and 1942; the most promising were Kenya C6040 × Dundee (41–157), Kenya C6040 × Ranee (41–119), and Kenya C6042 × Dundee (40–109). Of the newly acquired wheats from overseas, Frondoza, Frontiera, and Supreza (United States) have shown outstanding resistance to both stem and leaf rusts, but were susceptible to bunt (*Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetida*]) and flag smut. Federation 38

and Baart 38, reported resistant to stem rust in California, were very susceptible to this disease in South Australia in 1941 and 1942; on the other hand, their resistance to bunt was confirmed, and they were further shown to withstand infection by at least one race of *Ustilago tritici*. Ridit, Hussar, Nebred, Oro, and Rio (United States), and the stem rust-resistant Apex, Coronation, Regent, and Renown from Canada proved to be resistant to a collection of several races of *T. caries* and *T. foetida*. Rust-resistant spring wheats from Egypt were tested and good agronomic types possessing additional resistance to flag smut selected for yield trials in 1943. Several Australian wheat varieties, including Bordan, Dundee, Ford, Gluyas, Gular, Rapier, and Totagin, have been found resistant to at least one race of loose smut. A survey made in 1942 revealed the presence of *T. foetida* in six widely separated districts of the State. Two varieties, Rio and Oro, possessing the resistant genes R and T, respectively, have been selected as parents in breeding work. They are, however, susceptible to certain American races of bunt, and a search is therefore being made for varieties resistant to all races. So far, Hope and a durum wheat named Doubbi have shown promise in this respect.

A new flag smut of Wimmera rye grass has been shown to be distinct from similar diseases of wheat and rye. The pathogen, *Urocystis* sp., is capable of infecting its own host, *Lolium perenne*, and *L. rigidum*, but not wheat or rye.

Genetic studies on the inheritance of resistance to barley mildew (*Erysiphe graminis hordei*) have been instituted with a view to locating the six known 'resistant' genes on the various chromosomes. Preliminary tests indicated that race 3 of the fungus [ibid., xvii, p. 807] is present in South Australia [ibid., xix, p. 466].

A die-back of flax, which is most conspicuous when the plants are six to eight weeks old and involves the wilting of the top of the main shoot and a spotting of the lower leaves, was consistently observed in the field on patches of chocolate to dark grey soil, rich in limestone. Similar symptoms were induced in flax plants in water culture solutions by the omission of zinc, and in conformity with this result, the addition of zinc sulphate to the superphosphate drilled in with the seed was found greatly to reduce the incidence of diseased plants, with a corresponding improvement in the stand.

The prolific Punjab variety of flax is very susceptible to certain races of *Melampsora lini*, and attempts are in progress to combine it with the resistant Walsh.

In connexion with a project to determine the part played by fungi in the spotting of oranges stored at 40° F., particular attention was paid to the infection of the rind by *Colletotrichum* [*gloeosporioides*], which was found to occur before picking and to be controllable by appropriate spray treatments. The infection remains latent, however, for some time, and the conditions governing the appearance of the spotting in storage are still under investigation.

The Vetomold tomato variety has proved resistant to the local race of *Cladosporium fulvum* [ibid., xxii, p. 81 *et passim*], and on account of its many other desirable commercial qualities is being tested alongside Early Dwarf Red in the Adelaide market-garden district. In breeding against spotted wilt varieties have been found which are so tolerant of the disease that their productive capacity is not greatly impaired by it.

At least two genes appear to govern the resistance of bean varieties to halo blight (*Phytomonas* [*Xanthomonas*] *medicaginis* var. *phaseolicola*). Disease-resistant selections have been isolated from a Canadian Wonder × Burnley Selection cross.

The tomato spotted wilt virus was destroyed by exposure to a temperature of approximately 46° C. in ten minutes. At 40° it was still active after 30 minutes but non-infective after an hour, whereas the control suspension held at 20° had undergone no inactivation in this time. After two hours' exposure at 35° more

than 99 per cent. of the virus had lost its infectivity. In preliminary tests involving five hours' exposure of potted plants to a temperature of 40°, the concentration of active virus was reduced to 5 per cent. of that in the controls maintained at 20°.

The tomato spotted wilt virus was also inactivated at salicylate concentrations of 0·1 M and upwards at 30°. At 0·04 M the rate of inactivation pursued a logarithmic course for the first two hours, after which the concentration of active virus was reduced below the minimum for infection. Only slight inactivation occurred at 0·03 M. The temperature coefficient for this reaction is very high, the course of inactivation being materially slower at 20° than at 30°.

In connexion with attempts at the isolation of the tomato spotted wilt virus, precipitation was effected and a concentrate obtained by treatment of the infective juice with 25 per cent. ammonium sulphate solution. Difficulties were presented, however, by the inactivation of the virus at the relatively low temperatures developing during centrifuging.

Three diseases of suspected virus origin were recorded for the first time in South Australia, namely, daffodil [*Narcissus pseudo-narcissus*] stripe, blight of Williams' Favourite cherries, and a sectorial grooving of the fruits of Eureka lemons, a similar condition of which has also been observed in New South Wales. Features of the cherry blight were the very rapid withering of leaves and blossoms shortly after flowering and the death of branches, or even of the entire tree. The affected trees had had Napoleon-Beauchamp's Black scions grafted on to them for purposes of interpollination. Experiments are in progress to determine the possibility of transmitting the lemon and cherry diseases by budding or grafting.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xlii, 1, pp. 31–34, 5 figs., 1944.

In Victoria, *Sclerotinia sclerotiorum* causes an important transit and storage disease of carrots, which takes the form of a watery soft rot [*R.A.M.*, xx, p. 195]. The fungus is very widespread locally, and sunflower seed crops play a very important part in its dissemination [ibid., xxi, p. 405; xxii, p. 111], particularly in south-eastern Gippsland. Sunflowers are attacked in the seedling stage, but the disease may occur in mature plants, which produce viable seed before they are killed. The fungus produces its sclerotia in the seed heads of the sunflowers, and as these sclerotia are of the same size, colour, and consistency as the sunflower seeds they are not separated from them during the cleaning process. When the organism has become established in the soil, it is very difficult to eradicate it, because of its wide host range. In the field, it attacks celery, lettuce, French beans, tomatoes, cabbage, cauliflower, potatoes, cucumbers, and sunflowers, while in storage it infects nearly all vegetables except onions and potatoes. Under field conditions, it is favoured by cool, moist conditions. In southern Victoria it is most destructive in spring, early summer, and late autumn; in northern Victoria it may also occur in winter.

Experiments showed that healthy carrot roots were rotted completely in five days after being placed in contact with diseased ones.

To minimize losses, growers should avoid growing carrots in fields that have produced infected crops of any kind, particularly sunflowers. Clean cultivation must be practised, and weeds kept down. All injured and diseased roots must be discarded when bagging, and wet roots must not be bagged.

Under local conditions, oats are more widely affected by loose smut (*Ustilago avenae*) than by covered smut (*U. levis*) [*U. kolleri*]; the varieties Burt's Early, Frazier, Fulghum, Kanota, Kareela, and Myall have been claimed to be resistant to both.

Plant diseases. Notes contributed by the Biological Branch. —*Agric. Gaz. N.S.W.*, lv, 2, pp. 60–64, 5 figs., 1944.

Late blight of potatoes [*Phytophthora infestans*] first appeared in New South Wales in 1909, and by 1911 had spread over the whole of the potato-growing areas of the State. Spraying was introduced, and was adopted by many growers; the practice was maintained for some years in the Hunter River and Clarence River districts, but a succession of dry seasons and a decline in the losses due to the disease led to its abandonment. In 1943, heavy losses were sustained from the disease in the spring-planted coastal areas, which could have been prevented by spraying. The autumn-sown crops in these districts are likely to become infected, should the season prove wet, owing to the presence of large numbers of diseased potatoes that were discarded as a result of the spring outbreak. The problem of spraying largely resolves itself into one of providing suitable equipment. About 100 gals. of spray per acre should be used at each application.

Onion purple blotch [cf. *R.A.M.*, xx. p. 153] was favoured by moderately high temperatures. The causal fungus attacks the leaves and seed stalks, producing greyish lesions which enlarge, darken at the centre, and finally become purplish with concentric light and dark zones. The greyish portion may spread all round the leaf or stalk, stalks so affected falling over and dying. In the bulb crop the disease seldom causes losses, though it may kill the leaves and pave the way for bulb rots. The heaviest losses occur in the seed crop. Spraying has no effect. A crop which has become affected in the first season should not be used for seed. Bulbs for the seed crop should be grown from seed dipped in water at 122° F. for 25 minutes before sowing, and the seed-bed and the crop should be situated on new land or land which has not grown onions for several years; both the bulb and seed crops should be isolated as far as possible from other onions.

Washington Navel oranges and grapefruit in the coastal areas should be sprayed with Bordeaux mixture (3–3–80 plus ½ gal. white oil) in early autumn to control sooty blotch [? *Leptothyrium* sp.]. Lemons should be treated with Bordeaux mixture (6–4–100 plus ½ gal. white oil) against scab [*Sphaceloma fawcettii scabiosa*: ibid., xvi. p. 169: xx. p. 571], the spray being applied as soon as possible after half the petals have fallen.

To ensure good germination, pea seed should be dusted with spergon at the rate of 2 oz. per bush. This material was found to be very suitable where the seed was drilled in, owing to its good lubricating qualities, which assisted the free running of the drill, without clogging or cracking the seed. Satisfactory results are also given by the copper oxychloride dusts, cuprox, oxycop, bunticide, smutol, and soltosan, used at the rate of 2 oz. per bush., and by agrosan or ceresan, used at 1 oz. per bush.

Viljoen (P. R.). **Report of the Department of Agriculture and Forestry and of the Food Control Organization for the year ended 31 August, 1943.** *Emg S.Afr.*, xix, 216, pp. 131–201, 1944.

Among the very brief references to plant pathology in this report (p. 199) are the following items. Owing to seasonal conditions, peach curly leaf [*Taphrina deformans*], peach and apricot freckle [*Cladosporium carpophilum*], vine anthracnose [*Elsinoe ampelina*], and powdery mildew [*Uncinula necator*] were exceptionally severe in South Africa. Near Upington, sultanas were affected by a serious leaf disease caused by a hitherto unknown fungus. Close planting appeared to control tobacco kromnek [tomato spotted wilt virus]. Numerous groundnut varieties and crossings were tested for resistance to rosette [*R.A.M.*, xxi. pp. 4, 65], but all were susceptible. Inspection of citrus orchards for psorosis was continued, and of nearly 460,000 trees examined 972 or approximately 0·2 per cent. were found diseased.

Wiehe (P. O.). **Division of Plant Pathology.**—*Rep. Dep. Agric. Mauritius, 1942*, pp. 9–10, 1943.

During the period under review [cf. *R.A.M.*, xxii, p. 10], previous observations regarding the commercial resistance of the M.134/32 sugar-cane variety to red rot [*Colletotrichum falcatum*] were in general confirmed, though in an unusually severe outbreak of the disease at the Riche-en-Eau estate a reduction of 20 per cent. in the yield was sustained. M.72/31 was found to be more susceptible to red rot than it originally appeared.

In July, 1941, B.H. 19/12 sugar-cane cuttings from two localities, one (Forbach) infested by smut (*Ustilago scitaminea*) and the other (Réduit) virtually free from the disease, were planted alternately in four holes in 60 plots and their subsequent development watched. By the following December, 20 cuttings from the former source had contracted infection, and by May the total had reached 28, compared with only five from the healthy region (three in March and two in May). The early appearance (commencing in October) of smutted stools from the Forbach material suggests that it was already diseased at the time of planting, the later cases in both lots being probably due to secondary infection.

Sixteen citrus plants suffering from foliar chlorosis and die-back of the twigs were uprooted, and over half the roots in all of them were found to be dying or dead. Out of 64 cultures of root sections on Wilbrink's agar, 50 tubes yielded species of *Fusarium*, inoculations with which on sour orange seedlings, however, yielded negative results.

Sisal leaves on a Black River estate bore yellowish-white patches enclosing circular areas of normal green tissue; the discoloured portions ultimately dried out into shrivelled, chocolate-brown lesions. The disease, which broke out suddenly in several fields, and was subsequently observed at Grand Bay, in the north of the Island, is tentatively attributed to climatic conditions.

Reichert (I.). **Plant disease research in war-time.**—*Hameshek Hahaklai*, v, 12, pp. 5–7, 1943. [Hebrew.]

As a result of war conditions, the citrus groves in Palestine have been allowed to fall into neglect, and vast losses have resulted. The two principal troubles are anthracnose [*Colletotrichum gloeosporioides*] and *Diplodia* diseases [? chiefly *D. natalensis*: *R.A.M.*, xx, pp. 13, 111]. Citrus fruits are mainly affected by mould [*Penicillium italicum* and *P. digitatum*] and *D.* [*natalensis*], which were controlled by dipping in disinfectant solutions or the use of wrappers impregnated with diphenyl [ibid., xxi, p. 13].

'Mal secco' disease of lemons [*Deuterophoma tracheiphila*: ibid., xx, p. 398] is spreading in Palestine, largely because control is not undertaken when the condition is first seen. In its early stages it can be eradicated by drastic pruning and the removal of infected material. The Interdonato and Monachello varieties are resistant [ibid., xvii, p. 521; xviii, p. 245], have given good-quality fruit, and are free from the disease. At Rehovoth, trees were infected, but recovered after pruning. Scions of these varieties will be made available. Psorosis [ibid., xx, p. 359; xxi, p. 449; xxii, pp. 62, 63] has spread on Valencia orange and grapefruit trees.

Littauer and Zimmermann found that healthy potatoes can be grown from healthy seed in Palestine provided that plants are constantly rogued to eliminate virus diseases. The autumn crop, sown in August or September, can be lifted in November or December. With Up-to-Date and Arran Banner, the dormancy period is so long that tubers lifted in November are not normally fit for sowing in February. If, however, their dormancy is broken by heating or ethylene chlorhydrin treatment, they can be sown in February. In this way, three generations can be grown in one year. In rainy winters, such as that of 1942–3,

Phytophthora [*infestans*] reaches epidemic proportions. Spraying with Bordeaux mixture and perenox increased the yields two- to threefold and markedly improved their grade composition. Powdery mildew [? *Erysiphe cichoracearum*, ibid., xx, p. 380], which has become widespread during the past two years, was controlled by sulfinette [ibid., xi, p. 494] and cita Californian spray.

Cucumbers are affected by downy and powdery mildews [*Pseudoperonospora cubensis* and *E. cichoracearum*, respectively]. Palti has ascertained that under local conditions treatments (sulphuring against powdery mildew and spraying with Bordeaux mixture against downy mildew) must be applied at intervals of four days to secure control. Bordeaux mixture injured the plants, while perenox and cuprogreen did not, and increased the yields up to 70 per cent., also extending the picking period until late summer.

The cultivation of broad beans had been discontinued because of attacks by rust [*Uromyces fabae*] and chocolate spot [*Botrytis cinerea*], but experimental spraying with perenox gave such good control that yields were increased by 60 per cent.

Carrots are attacked chiefly by powdery mildew [? *Oidium* sp.] and blight due to *Macrosporium* [*carotae*]; sulphur treatment controls the former, while the latter, which caused severe losses in many areas in the spring of 1943, can be checked by copper sprays.

The root disease of apples caused by *Polyporellus* [*rhizophilus*] and the trunk disease due to *Dothiorella* sp., have spread considerably since the outbreak of war. Two applications of sulfinette and cita Californian spray prevented the premature defoliation of stone fruit trees by rust [*Puccinia pruni-spinosae*, see below, p. 262]. Vines suffered heavy losses from powdery mildew [*Uncinula necator*] all over the country and from downy mildew [*Plasmopara viticola*] in the coastal plain. Experimental evidence clearly showed that the correct timing of sulphur applications against *U. necator* is essential for their success: treatments should precede the appearance of the disease.

Clover fields dried up or rotted as a result of attack by leaf diseases, particularly *Ascochyta* leaf spots [mainly *A. trifolii*], and by stem and root troubles due partly to *Fusarium* sp. and partly, it is thought, to adverse soil conditions.

Fawcett (G. L.). **Departamento de Botánica y Fitopatología.** Ex *Memoria anual del año 1942*. [Department of Botany and Phytopathology. *Ex* Annual Report for the year 1942.]—*Rev. industr. agríc. Tucumán*, xxxiii, 4-6, pp. 63–65, 1943.

This report [cf. *R.A.M.*, xxi, p. 481] contains the following items of phytopathological interest. Sugar-cane smut [*Ustilago scitaminea*] has spread all over Tucumán [ibid., xxiii, p. 150], causing an average infection of 5 to 10 per cent. In P.O.J.36, however, the losses have been really serious, necessitating the replanting of certain fields.

In connexion with the prevalent vine anthracnose attributed to *Sphaceloma ampelinum* [*Elsinoe ampelina*: ibid., xxii, p. 236], the absence of the characteristic red halo round the lesions on the grapes casts a slight doubt on the exact identity of the pathogen, the growth of which in culture, however, was typical of the species.

As in previous years, chick peas [*Cicer arietinum*] were affected by a malady involving the decay of the tap-root tips and the desiccation of the plants without producing seed. In 1942 the normal planting date was postponed on account of the severe winter weather, with the result that the crop was attacked while still green and in full flower. A species of *Pythium* was found in the soil underlying the diseased patches, but is not thought to cause the disease. The true source of the trouble is likely to be either in the nature of the soil or in the water relations of the subsoil.

Mosaic is the most destructive disease of potatoes. In an experiment in which

aphids (*Myzus persicae*) were placed on a healthy plant protected from access by other insects, the plant itself shrivelled without developing the characteristic symptoms, which appeared, however, on the new shoots arising from the tubers. Seed imported from the Province of Buenos Aires usually produces healthy plants, but in 1942 it gave rise to many diseased ones.

Verticillium albo-atrum, the agent elsewhere of a cotton wilt, is responsible in Tucumán merely for a chestnut-coloured spotting of the leaves, which are subsequently shed except for the youngest. Fibre production is not noticeably impaired.

Principales enfermedades de origen parasitario que fueron objeto de consulta en el semestre Julio–Decembre de 1942. Principales enfermedades fisiogenicas que fueron objeto de consulta en el semestre Julio–Decembre de 1942. [The principal diseases of parasitic and physiogenic origin which were the subject of consultation during the half-year July to December, 1942.]—*Bol. Sanid. veg., Santiago*, ii, 2, pp. 152–155, 1943.

The following were among the parasitic and physiogenic diseases on which the phytopathologists of the Chilean Ministry of Agriculture were consulted during the period from July to December, 1942 [cf. *R.A.M.*, xxii, p. 470]: *Ascochyta cherimoliae* on *Annona cherimolia*, *A. pisi* on peas, *Alternaria brassicae* var. *nigrescens* [*A. cucumerina*] on watermelon, *A. solani* on potato, *Bremia lactucae* on lettuce, *Cladosporium carpophilum* on plum, *Coryneum beijerinckii* [*Clasterosporium carpophilum*] on peach, *Colletotrichum gloeosporioides*, *Penicillium digitatum*, and *P. italicum* on lemon and orange, the former also sustaining foliar scorch from Bordeaux sprays, *C. lindemuthianum* on bean, *Cycloconium oleaginum* on olive, *Venturia pirina* on pear, *Dendrophoma marconii* on hemp, *Melampsora lini* on flax, *Mycosphaerella fragariae* on strawberry [*Fragaria chiloensis*], *Peronospora trifoliorum* on lucerne, *Phytomonas* [*Bacterium*] *tumefaciens* on vine and plum, *Podosphaera leucotricha*, *Sphaeropsis malorum* [*Physalospora obtusa*], and bitter pit on apple, *Rhizoctonia* [*Corticium*] *solani* on Monterey pine (*Pinus radiata*) seedlings, and *Taphrina aurea* on poplar.

Posnette (A. F.). **The diagnosis of swollen-shoot disease of Cacao.**—*Trop. Agriculture, Trin.*, xxi, 3, pp. 56–58, 1944.

After pointing out that earlier accounts of cacao swollen shoot [*R.A.M.*, xxiii, p. 6] failed to give a complete picture of the symptomatology of the disease because they omitted to take into account the presence of different strains of the virus and overlooked the basis of the pattern in the leaf chlorosis, the author gives a description (which is not claimed to be full or final) of the symptoms collectively; a great deal of the variation presented by the symptoms is due to a corresponding variation in the virus. In this respect, as in the symptoms themselves, the disease presents a remarkable parallel to the peach mosaic complex in North America.

The principle underlying all the leaf chlorosis symptoms of the strains studied appears to be vein-clearing. As a rule, this appears as white flecks, before the leaf changes from pink to green. As the pink fades, other areas become defined, which later are almost transparent or pale yellow, but which retain the pink pigment longer than the rest of the leaf, a pink mottle thus developing on a pale green background. This mottle generally forms a network, marking the veins. As a rule, some transparent streaks are also visible, representing veins from which the pigment has cleared. As the chlorophyll develops and the leaf hardens, the final pattern of the yellow mosaic is formed. This varies with the virus strain and the lapse of time between infection and the development of the leaf.

If flushing occurs four to six weeks after infection, only a few tertiary and smaller veins are cleared, and spots or L- or T-shaped streaks result. If flushing is long delayed, secondary veins may also be cleared, but this is generally a later symptom

that develops on flushes subsequent to that showing the first sign of infection. Usually, the later the stage of infection when the flush develops, the fewer and larger are the cleared areas. The 'feather stage', when the mosaic pattern follows the primary veins and resembles a feather, would seem to indicate that infection has taken place nine to twelve months previously. Subsequent flushes do not always show mosaic, but, with virulent strains, the leaves are nearly always small and pale, and few to a flush.

In all experimental transmissions the mosaic pattern remained fixed until masked by the general yellowing of an old leaf. In most instances, the mosaic is most conspicuous in a young leaf and gradually fades as the leaf ages. Mosaic was never seen to appear after a leaf had hardened; the only symptoms observed in leaves formed before infection was a premature yellowing.

The virus often causes a crinkle, the areas between the main veins bulging dorsally, so that the leaf develops a wavy edge. Sometimes the whole leaf is puckered up. In other cases, large areas die between the main veins, which become drawn closely together, twisting the leaf. The interveinal areas may turn brown and fall out. This necrosis may occur at the edge or tip of a leaf. With all virulent strains, a common symptom is decrease in leaf size. In many affected plants, this dwindles progressively with each flush, until new leaves are less than one quarter the normal area. The period when the leaf changes from pink to green is critical; the leaf may wilt, whiten, and fall.

The development of dwarfed, rounded pods seems to be restricted to the most virulent form of the disease. Unripe pods may show a dark green mottle, but this mottling is pink if developed in direct sunlight. As the pod ripens, the mottle turns green or yellow, disappearing as the pod becomes fully ripe. This was the first sign of infection in transmission experiments with bearing trees. As the pod is growing continuously it immediately becomes affected by the virus, whereas a new flush has to develop before the leaf symptoms become visible.

No small swelling on the stem bearing signs of insect attack should be regarded as diagnostic. Short internodes are a symptom, but are also often due to psyllid infestation. An infected tree usually flushes later than healthy ones in the vicinity; it may miss one flush, and can be detected by the absence of green wood at the branch tips and the presence of numerous old, lichen-covered leaves. Die back is a symptom of virulent strains.

The only known root symptoms are swellings, generally on the tap-root of seedlings and young saplings and on the main laterals of older trees. No abnormalities have been noted in the flowers.

VALLEGA (J.). **Especialización fisiológica de Puccinia graminis tritici en Brasil.** [Physiologic specialization of *Puccinia graminis tritici* in Brazil.] —*An. Inst. fitotec. Santa Catalina*, iii, pp. 29–36, 1 fig., 1941. [English summary. Abs. in *Exp. Sta. Rec.*, xc, 3, pp. 349–350, 1944.]

Physiologic races 15, 17, and 42, especially the first, of *Puccinia graminis tritici* were found to be widely distributed in the wheat-growing region of Brazil. The same races, together with 11, are likewise very prevalent in Argentina and Uruguay [*R.A.M.*, xxi, p. 188]. Since the appearance of new races of the rust is not very frequent in these South American countries, the breeding of varieties resistant to the four in question offers considerable promise of control.

LIVINGSTON (J. E.) & KNEEN (E.). **A rag-doll technique for the inoculation of Wheat with bunt (Tilletia levis).** —*Phytopathology*, xxxiv, 1, pp. 124–128, 1 fig., 1944.

Duddleston's rag-doll method of inoculation (*Bull. Purdue agric. Exp. Sta.* 236, 1920), modified by the omission of the paper round the cloth, was found to be particularly well adapted to studies at the Nebraska Agricultural Experiment

Station involving the germination and artificial infection of Ceres wheat with bunt (*Tilletia levis*) [*T. foetida*] under uniform conditions. High percentages of disease (up to 95·5) were secured by pre-germination of the spores in rag dolls, followed by the addition of soaked wheat seed-grain to the same dolls on the appearance of primary sporidia. Seven to ten days at 10° C. were requisite for the adequate germination of the spores, succeeded by a 10- to 14-day period at the same temperature to permit the production by the germinating wheat of sprouts about 30 mm. in length: at this size the seedlings could easily be transplanted into sand or soil. The presence of chlorotic spots on the leaves served as a preliminary criterion of the extent of infection by *T. foetida*, though this feature was sometimes indicative of other pathological conditions.

Potapov (A. I.), Soukharev (A. A.), & Chelpanova (Mme A. I.). К вопросу о биологии **Tilletia tritici.** [Concerning the biology of *Tilletia tritici*.]—*J. bot. U.R.S.S.*, xxviii, 3, pp. 110–116, 1943. [French summary.]

In a study conducted in Siberia with *Triticum vulgare* var. *ferrugineum*, the authors found that under the influence of infection by *Tilletia tritici* [*T. caries*: *R.A.M.*, xxi, p. 519], the length of the ear remained unchanged, being 5·605± 0·0421 cm. in healthy plants as against 5·725 ±0·0489 cm. in infected ones; the number of grains was larger in the infected ear than in the healthy one, 28 as against 24; the healthy grain was longer than the diseased, 5·695±0·0449 mm. as against 4·765±0·0823 mm.; and also thicker, 2·897±0·0212 mm. as against 2·3108±0·0327 mm.; and the weight of healthy grains, 21·725±0·435 mg., considerably greater than that of diseased ones, 9·266±0·1861 mg. In plants of the var. *lutescens* grown in the same field the average weight of healthy grains was 34·578 mg. as compared with 11·159 mg. in those infected with *T. caries*. The average weight of the grain coat in healthy plants exceeded that of infected ones by 1·595 mg. in var. *ferrugineum* and by 1·596 mg. in var. *lutescens*, the loss in weight due to infection amounting to 67 and 55 per cent., respectively. The loss of nutritive substance in grain in the presence of spores of *T. caries* was found to amount to 56 per cent. of that of healthy grain for var. *ferrugineum* and 68 per cent. for *lutescens*. The weight of bunt spores contained in one grain was on the average greater in *lutescens* (9·859 mg.) than in *ferrugineum* (8·511 mg.). In mixed samples of grain from the Irkutsk district, the number of bunt spores per gm. was 141,000,000, the weight of spores in one infected grain was 0·01037 gm., and from these figures the number of bunt spores in one infected grain was calculated as being 1,462,170; in mixed samples of grain from the Biysk district the corresponding figures were 174,000,000, 0·01173 gm., and 2,041,020. The specific weight of bunt spores in grains from Irkutsk was 1·26. In germination tests, sufficient air circulation, a moderate humidity, and the presence of oxygen were found essential. The spores of *T. caries* exhibited a high degree of resistance to frost, not only when dry but also when swelling or actually in the process of germinating. Alternate freezing and thawing of moist spores retarded their germination considerably, the first germ-tubes appearing on the 16th day, and the first falciform conidia and the mycelium on the 23rd.

Vallega (J.) & Cenoz (H.). **Reacción de algunos Trigos a las razas fisiológicas de Erysiphe graminis tritici comunes en Argentina.** [Reaction of some Wheats to the physiologic races of *Erysiphe graminis tritici* common in Argentina.]—*An. Inst. fitotec. Santa Catalina*, iii, pp. 45–58, 1941. [English summary. Abs. in *Exp. Sta. Rec.*, xc, 3, p. 350, 1944.]

During the three years previous to the date of writing, severe attacks of powdery mildew (*Erysiphe graminis*) were observed on wheat in Argentina, where the disease, though common, is not ordinarily of economic importance. Tests of

collections from several localities revealed the presence of at least three physiologic races, easily differentiable on the Chul and Sonora varieties and apparently distinct from those described from the United States and Germany. All the varieties widely grown in Argentina proved to be susceptible to the mildew races. The new variety Klein 157, besides several selections from Hope × Lin Calel, was moderately susceptible, whereas one selection from Riccio × Lin Calel showed high resistance. Of the foreign wheats tested, Normandie, Axminster, and a Russian selection were immune, and should therefore be valuable for breeding, especially the first-named, which is also resistant to leaf rust [*Puccinia triticina*]; Hope, Regent, and Renown Selection R.L. 716·6 showed moderate resistance. All strains of *Triticum durum*, *T. polonicum*, *T. turgidum*, *T. spelta*, *T. macha*, and *T. compactum* tested were susceptible, and those of *T. timopheevi* immune, while *T. monococcum*, summer wheat, and *T. dicoccum* comprised both susceptible and resistant forms.

Soukhov (K. S.). Получение очищенного белкового препарата вируса мозаики озимой Пшеницы. [The isolation of purified winter Wheat mosaic virus protein.]—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxxix, 2, pp. 72–73, 1943.

Examination of wheat plant tissue infected with the virus of winter wheat mosaic and treated with solutions of acids or acid salts at $P_H 4$ or with acid fixatives, revealed the presence of numerous needle-like crystals identical with those previously found in juice extracted from mosaic-diseased leaves and in the intestines of the vector, *Deltocephalus striatus*, in acid media at $P_H 4$ [*R.A.M.*, xx, p. 522]. The crystals were present only in the cells of the parenchyma adjacent to the vascular bundles. In these cells deterioration or sometimes complete disappearance of plastids could be observed. A purified preparation of the virus was obtained by macerating diseased wheat leaves in a small quantity of 0·1 per cent. soda solution, filtering the extract from this pulp through Seitz asbestos disks, and adding, carefully and slowly, a small quantity of N/10 acid salt solution to the clear filtrate. At the point of contact between the filtrate and the acid solution a white film formed, consisting of needle-like crystals. On the test tube being shaken repeatedly, the filtrate became cloudy; at P_H approximately 4, a dense, brownish precipitate of crystals was obtained after short centrifuging. Micro-chemical reactions proved the protein nature of the crystals. No inoculation experiments could be carried out at the time, so that the identity of the protein with the virus, though very probable, could not be established. The mosaic disease of winter wheat is considered to belong to the 'yellows' group.

During 1941, Soukhov, Vovk, and Mme Alekseeva are stated to have obtained pure preparations of the virus causing pseudo-rosette of cereals by the above-mentioned method (results unpublished). The two viruses can be distinguished by the following characteristics, in addition to those already known [ibid., xxiii, pp. 210–213]. The winter wheat mosaic virus forms numerous crystals when leaves are macerated in a N/10 solution of acid salt but only a few when they are macerated in water, and its purified preparation can be preserved only at $P_H 4$; the virus of pseudo-rosette forms crystals when leaves are macerated in water but none when in a N/10 solution of acid salt, and its purified preparation can be preserved only at $P_H 5$.

Vallega (J.). **Razas fisiológicas de Puccinia graminis avenae halladas en Argentina.** [Physiologic races of *Puccinia graminis avenae* collected in Argentina.] — *Rev. Fac. Agron., B. Aires*, x, 3, pp. 517–529, 1 fig., 1943. (Issued 1944.) [English and Portuguese summaries.]

Between 1939 and 1941, physiologic races 3 and 7 of *Puccinia graminis avenae* were found in three provinces of Argentina, viz., Buenos Aires, Santa Fe, and Córdoba. All the indigenous and Uruguayan oats tested were very susceptible to

both races, but the following foreign varieties, and several hybrids derived therefrom, were resistant: Rainbow, Richland, Iogold, Green Russian, and Hawkeye. A certain degree of susceptibility to the rust was shown by the grasses *Dactylis glomerata*, *Poa bonaerensis*, *P.* aff. *lanigera*, *P. iridifolia*, *Bromus hordeaceus*, *Briza triloba*, *Phalaris minor*, and *P. angusta*.

Vallega (J.). **Especialización fisiológica de Puccinia coronata avenae, en Argentina.** [Physiologic specialization of *Puccinia coronata avenae* in Argentina.]—*An. Inst. fitotec. Santa Catalina*, ii, pp. 53–82, 3 figs., 1940 [? after 1941]. [English summary. Abs. in *Exp. Sta. Rec.*, xc, 1, p. 63, 1944.]

Physiologic races 1, 45, 55, and 56 of oats crown rust (*Puccinia coronata avenae*) were comprised in the 137 samples collected between 1939 and 1941 in Argentina [*R.A.M.*, xxi, p. 184]. The principal common feature of the four races was their high degree of virulence to the differential varieties Green Russian, Hawkeye, Anthony, Sunrise, Green Mountain, White Tartar, Appler, Sterisal, and Belar: they were separable, however, on the basis of their pathogenicity to Ruakura, Bond, and Victoria. Race 1, which predominates in Canada, the United States, and Mexico, was likewise found to be more prevalent than the other three in Argentina. Of the native and foreign varieties tested for their reactions to the four races, only Glabrota was resistant to all, and this derivative from *Avena strigosa* offers little practical interest.

No evidence of differences in the reaction to crown rust of seedling and adult plants was afforded by field observations. In the vicinity of Buenos Aires the uredospore stage persists throughout the year; in the summer it has been found on 'volunteer' and wild oats plants, which are believed to assist materially in the propagation of the rust. The four above-mentioned races of *P. coronata* have also been isolated in Argentina from *A. fatua* and *A. sterilis* vars. *ludoviciana* and *macrocarpa*. Among other Gramineae tested, *Lolium* and *Bromus* spp. and *Amphybromus scabrivalvis* proved resistant, a few plants each of *Dactylis glomerata* and *Poa annua* reacted divergently, and *Phleum pratense* was susceptible to race 1 only. These grasses would therefore appear to be of little importance in the spread of crown rust, except as possible reservoirs of infection.

Dennis (R. W. G.). **Seed-borne diseases in Scottish seed Oats.**—Reprinted from *Scot. Fmr, 24th July, 1943*, 7 pp., 1943.

With a view to ascertaining the state of health of the seed oats being marketed in Scotland, 261 random samples of seed from the 1942 crop from all over the country were examined at the Seed Testing Station of the Department of Agriculture for Scotland. One hundred seeds from each sample were sown in sterile sand at a depth of about 2½ in., to be dug up and washed for examination when the second leaf was showing. The results showed that the maximum amount of infection with the leaf stripe fungus, *Helminthosporium avenae* [*R.A.M.*, xxii, p. 473], including the pre-emergence blight, was 42 per cent. and the average 11·55 per cent., altogether 87 samples, or 41 per cent., of those tested having only 5 per cent. or less infection. A surprising feature was the large amount of seedling foot rot (maximum 80·00 and average 21·04 per cent.) (i) of a severe type, where the stem shrivelled up from the seed upwards beyond the first node, the leaves turned yellow, and the plant usually died; and (ii) of a mild type, where only the part of the stem below ground was affected. From the foot-rot lesions two species of *Fusarium*, *F. nivale* and *F. culmorum*, were isolated. In infection tests with oat seeds (variety Victory) inoculated with various *Fusarium* spp., it was found that both indoors and out the fungi were far more destructive in sand than in soil, possibly owing to excess moisture in sand cultures. This would indicate that oats sown in wet sand may suffer considerable losses due to rotting of the seed by

Fusarium spp. *Gibberella zeae* was not pathogenic to oats in soil and sand out of doors, and only feebly pathogenic at the higher temperature in the laboratory. It is concluded that under Scottish conditions *F. nivale* may cause serious losses, *F. culmorum* is likely to be less destructive except where soil temperatures are high or conditions are unfavourable to the growth of the plant, and *G. zeae* is of little importance. The data from three farm tests with seed previously examined in the laboratory indicated that disinfection with organo-mercury may offer some protection against rotting fungi in the soil during germination, which is the period when *Fusarium* spp. and similar soil fungi are most likely to cause injury. The results of this study lend support to the official view that all cereal seed should be dressed with an organo-mercury disinfectant before sowing.

TERVET (I. W.). **The relation of seed quality to the development of smut in Oats.**—*Phytopathology*, xxxiv, 1, pp. 106–115, 1944.

Plants from seed lots of Anthony, Gopher, Rusota, Iogold, and Black Mesdag oats from different parts of Minnesota were tested in 1940 and 1941 for resistance to *Ustilago levis* [*U. kolleri*] and *U. avenae* [*R.A.M.*, xx, p. 568]. The variation in smut incidence between plants from different seed lots of the same variety was found to be equal to that occurring between the several varieties. For instance, the percentage of infection by *U. avenae* in Anthony in 1940 ranged from 2 to 40, the corresponding figures for Gopher, Rusota, and Iogold being from 0 to 20, 1 to 20, and 0 to 26, respectively. In 1940 the percentages of infection by *U. kolleri* on the same four varieties ranged from 14 to 72, 2 to 50, 1 to 14, and 0 to 21, respectively, and in 1941 on Anthony and Gopher from 18 to 89 and 4 to 51, respectively. In 1941, the incidence of *U. kolleri* on Anthony and Black Mesdag plants from seed lots originating in seven States of the Union and one (Alberta) in Canada ranged from 49 to 83 and from 7 to 60, respectively. The discrepancies in the amount of smut between the various lots are attributed to modifications in the seed resulting from the particular environmental conditions under which the several samples were produced, rather than to genetic differences in the constitution of the plants.

When seed lots were dehulled and inoculated by dusting dry chlamydospores on the naked caryopsis, smaller (though still significant) differences in smut incidence were recorded than by the use of the partial-vacuum method. One sample of Anthony, inoculated by the latter technique, produced plants with only 19 per cent. smut compared with 61 in a lot subjected to infection of the caryopsis by dusting with chlamydospores. It is concluded that the relative tightness of the hulls enveloping the caryopsis is responsible for the variation in the incidence of smut on plants from different seed lots.

The sample of Anthony oats yielding the fewest diseased plants germinated more rapidly and produced larger seedlings than the other lots of the same variety, suggesting that more vigorous plants are less liable to infection than weaker ones.

On the basis of these observations the author recommends the use of seed from one harvest for a successive period, e.g., of five years, for the purpose of physiologic race determination, such a procedure being more likely to ensure uniform results than annual trials of new lots.

ROY (W. R.). **Studies of boron deficiency in Grapefruit.** *Citrus Ind.*, xxiv, 8, pp. 4–5; 9, pp. 5, 8, 1943. [Abs. in *Chem. Abstr.*, xxxvii, 21, pp. 6306–6307, 1943.]

Boron deficiency symptoms induced in grapefruit trees growing in sand cultures included curling of the leaves, corking of the veins, extensive defoliation, excessive dropping of the fruits, the development of boron stains in the albedo, malformation, and the production of a drop of crystal gum on the receptacle remaining on the

trees after the shedding of the fruits. Rough lemon should be a more suitable root stock than sour orange for grapefruit trees where boron deficiency is to be feared, owing to the larger intake of the element by the former.

Klotz (L. J.). **Brown rot and gummosis infections causing serious losses.**—*Calif. Citrogr.*, xxix, 5, p. 116, 4 figs., 1944.

Brown rot and gummosis [*Phytophthora* spp.: *R.A.M.*, xxii, p. 354] are stated to have been causing unusually severe losses (particularly to lemon, Navel orange, and Valencia orange trees) in Californian orchards since 1938, owing largely to wet winters, lack of spray protection of fruit and of tree care. Growers are urged to apply sprays. The new compound tetrachloro-para-benzoquinone, when used at the rate of 1 lb. per 100 gals. gave satisfactory protection both in the grove and in the laboratory on detached fruits, but when used at the rate of $\frac{1}{4}$ or $\frac{1}{2}$ lb., was effective only in the laboratory, failing to protect fruits in the grove following 6 in. of rain and strong winds.

In the packing house, where the importance of the hot water treatment is again emphasized, the fruit, particularly lemons, when cold and turgid, should be permitted a period of slight wilting before immersion, as this obviates the danger of the liberation of rind oil which causes spotting. Although hot water treatment was experimentally shown to stop the progress of decay after the brown rot spots become visible to the unaided eye, in commercial practice fruit with such spots should be eliminated.

The excessive rainfall and flood conditions in southern California during the past several seasons are stated to have favoured the development of many cases of gummosis. It has been estimated that in Orange county alone 300,000 trees were found infected following the flood of 1938. Throughout the citrus belt old trees that have escaped infection for over half a century were found to be so badly diseased that tree surgery could no longer save them. Even the bud unions on the gummosis-resistant sour orange trees, where permitted to stand in contact or to be splashed with water swarming with the zoospores of the fungi, became infected. The standard surgical method recommended for the treatment of gummosis infections consists in the removal of the diseased bark and a $\frac{1}{4}$- to $\frac{1}{2}$-in. strip of healthy bark beyond the margin of the dark brown diseased area discernible on the inner surface of the bark or the surface of the wood, using a heavy, sharp knife for the smooth parts of the trunk and a scaly-bark scraper for the irregular bud union and crown and root areas. The exposed area is then dusted with spray-dried Bordeaux or zinc-copper-lime, or tetrachloro-para-benzo-quinone, or is painted with 1 per cent. permanganate of potash solution, or with a suspension of any of the above three dusts. The treated lesion is allowed to dry for a week or more, depending on the weather, and then painted with tree seal or white lead paint.

Blackford (F. W.). **Citrus fruit rots and blemishes.**—*Qd agric. J.*, lviii, 1, pp. 33–38, 2 figs., 1944.

Continuing his earlier paper [*R.A.M.*, xxiii, p. 175], the author gives brief, popular notes on the symptoms and control of the following diseases of citrus in Queensland: blue mould [*Penicillium italicum*], green mould [*P. digitatum*], brown rot [*Phytophthora citrophthora* and *P. parasitica*: ibid., xxii, p. 132], stem-end rot [*Phomopsis* [*Diaporthe*] *citri* or *Diplodia natalensis*: ibid., xx, p. 13], sooty mould, smoky blotch, or fly speck [*Leptothyrium* sp.: ibid., xvii, p. 587], oleocellosis [ibid., xix, p. 86], rind breakdown due to rain, dew, or excessive humidity [ibid., xx, p. 151], and stylar-end rot of limes produced by hot, dry weather.

Measures for the control of rind breakdown have not yet been finally drawn up, but it is suggested that the fruit should be picked as soon as possible after it has

matured, and that, if the trouble has already appeared, affected fruit should be carefully culled during packing, in order to avoid loss in transit. It is worth while to hold the fruit a little longer than usual in the packing shed, so that fruit with a tendency to rot may be discarded.

The incidence of stylar-end rot may be reduced by keeping the soil moist, applying smaller amounts of fertilizers rich in nitrogen, and picking the fruit early.

Sandoz (Mildred D.), Rogers (Rosalie), & Newcombe (C. L.). **Fungus infection of eggs of the Blue Crab, Callinectes sapidus Rathbun.** —*Science*, N.S., xcix, 2563, pp. 124–125, 1944.

Blue crab (*Callinectes sapidus*) eggs infected by fungi identified by J. H. Couch as *Lagenidium callinectes* [*R.A.M.*, xxii, p. 136] and *Rhizophidium* sp. in Tidewater, Virginia, are usually under-sized, and gave rise in laboratory tests to abnormal prezoeae, which rarely survived longer than 48 hours. Infected egg masses suspended in the York River in 1942 failed to hatch, and substantial fungal growth was made. Infection may occur at all stages in the development of the eggs, its incidence varying markedly in different parts of the area under observation. The parasitic fungi represent an important contributory factor in the reduction of the population of *C. sapidus*, and attention should be paid to their distribution in any site likely to be selected as a reservation for the protection of brood stock.

Magee (C. J.). **Orchid mosaic.**—*Aust. Orchid Rev.*, viii, 4, pp. 51 52, 2 figs. (1 on p. 53), 1943.

Cymbidium orchids in New South Wales are liable to a form of mosaic known to members of the Orchid Society as 'black disease'. The first symptom of infection is a yellow flecking or streaking of the youngest leaves, followed by the development of black spots and streaks on both the upper and lower surfaces. Growth is retarded and the plants become more or less enfeebled according to the variety affected. A species of *Dendrobium* has also been observed to bear the mosaic lesions, the agent of which is probably the tomato spotted wilt virus, though its exact identity requires further study. Precautionary measures pending a fuller knowledge of the disease should include the rejection of all suspected plants for propagation, the removal of weeds and diseased ornamentals from the vicinity of the collections, and the isolation of infected orchids.

Sprague (R.). **Phoma terrestris on Gramineae in the northern Great Plains.**—*Phytopathology*, xxxiv, 1, pp. 129–131, 1944.

During the three-year period from 1940 to 1942, *Phoma terrestris* represented only 2·3 per cent. of the 16,086 pure cultures of all species of fungi isolated from the roots of field-grown plants in North Dakota, but it numbered among its hosts 55 members of the Gramineae [*R.A.M.*, xxi, p. 118], including oats, barley, sorghum, Sudan grass, wheat, maize [ibid., xxii, p. 429]. *Agropyron* spp. (seven), *Andropogon furcatus* and *A. hallii*, *Bromus inermis*, *Dactylis glomerata*, *Echinochloa crus-galli*, six species of *Elymus*, *Festuca rubra*, *Panicum miliaceum*, *Phleum pratense*, *Poa pratensis*, *Setaria italica*, and *S. viridis*, besides *Allium cernuum*, vegetable marrow, flax, and *Lepidium campestre*. The results of greenhouse inoculation experiments showed the fungus to be, at the most, very weakly parasitic, and probably only pathogenic to plants making slow growth in cool (50° F.), wet soil. The pink-root condition in maturing cereals represents a saprophytic phase of *Phoma terrestris* on small roots killed by other fungi, notably the destructive *Pythium arrhenomanes*, or by drought.

Some cultures of the pink-root fungus from grasses and wheat produced elliptical, hyaline pycnospores, 3 to 4·8 by 1 to 1·5 μ, on *Melilotus* culms or maize meal in flasks, but even the sterile cultures, with their mounded, velvety, grey, rose-,

plum-, or vinaceous-tinted colonies, are readily distinguishable from those of other Graminaceous fungi. Considerable variation is noticeable in the fungus and several distinct strains are distinguishable.

Fruit tree spraying in Kent.—*J. Minist. Agric.*, li, 1, pp. 43–44, 1944.

A special Spraying Advisory Committee, established by the Kent War Agricultural Executive Committee, has evolved a scheme by which fruit-tree spraying machines supplied to the Committee are hired out to contractors, each of whom is given a certain area to work. The contractor sprays any orchard in his area at the request of the Committee's local Fruit Surveyor, and may also spray any other orchards belonging to farmers who lack equipment. The scale of charges laid down by the Committee has been accepted by all the contractors. A simple spray schedule has also been recommended. The machines have tanks of 250 gals. capacity and can deliver up to 15 gals. of spray per minute. As they travel between the rows one operator sprays the trees on one side and a second those on the other. Over 50 of these machines are already at work in Kent.

Moore (M. H.). **Control of Apple scab.**—*Fruitgrower*, xcvii, 2523, pp. 295–296, 1944.

On the basis of experience at the East Malling Research Station, the author makes two practical suggestions for the assistance of fruit-growers in controlling apple scab [*Venturia inaequalis*]. In the first place, not more than a fortnight's interval should separate consecutive treatments at the green-cluster, pink-bud, and petal-fall stages. If pink-bud rapidly follows green-cluster on account of weather conditions, the appropriate treatment should not be omitted, but the most susceptible varieties at any rate should be sprayed with lime-sulphur alone at a strength of 1 or 1·5 per cent. Following the 2·5 per cent. with or without lead arsenate at green-cluster, the weaker spray will be quite innocuous, and will freshen up the deposit for the blossom period. Another important point is to have all the apparatus in readiness to start the petal-fall application not more than a fortnight after pink-bud, even if there is still a fair sprinkling of bloom on the trees. In fact, trees in full bloom have been sprayed with 1 per cent. lime-sulphur or 6 lb. colloidal sulphur per 100 gals. without interrupting the activity of bees for more than an hour or so [*R.A.M.*, xxii, p. 315], and a full crop was subsequently picked. Once scab gains a foothold among the minute fruitlets, dropping ensues and the crop will be greatly reduced. Lead arsenate should not be added to the 1 per cent. lime-sulphur spray at petal-fall owing to the risk of arsenical injury and the danger to bees working late blooms [loc. cit.], but nicotine may be applied at this stage against sawfly [*Hoplocampa testudinea*]. Copper-lime dusts have been helpful to many growers in tiding over a long blossom period. It is most inadvisable to postpone scab control treatment even for a few days in the critical months of April and May.

Perlberger (J.). **The rust disease of stone fruit trees in Palestine.** Perlberger (J.) & Palti (J.). **Spraying trials for the control of the rust disease of stone fruits.**—*Bull. Rehovoth agric. Exp. Sta.* 34, 17 pp., 8 figs., 1943. [Hebrew, with English summary.]

Puccinia pruni-spinosae is found in Palestine on the leaves of almonds, plums, apricots, peaches, and nectarines, on which it produces yellow, angular lesions, though on peach leaves they may be round. It sometimes has a complete life-cycle; uredospores and teleutospores were found on stone fruits, and aecidia on *Anemone*. It may be assumed that infection is spread chiefly by uredospores, completion of the life-cycle being of minor importance. Locally, the disease may develop in all parts of the country during winter, but in summer only areas with a relatively low temperature and high atmospheric humidity are affected. This

means that in summer the rust is found in the coastal region and the mountainous parts, but not in the Jordan Valley or the eastern section of the Esdraelon Valley. On stone fruit trees infection spreads for the most part after harvest, from July onwards, through autumn and winter, and causes premature defoliation. Occurrence in spring is rare. Under the local conditions, the fruits are not affected. The development of the rust is further restricted by *Darluca filum*, which is often found on the sori.

In two years' spraying trials, the lime-sulphur spray sulfinette (33° Bé) [see above, p. 253] at a concentration of 1 in 60 controlled *P. pruni-spinosae* on seedlings of bitter almond, myrobolan plum [*Prunus divaricata*], and apricot, and on Kelsey, Santa Rosa, and Wickson plum trees, while it also prevented premature defoliation. In one year's trial, spraying with cita lime-sulphur spray (33° Bé) [loc. cit.] at 1 in 60 controlled the disease on bitter almond seedlings and prevented premature defoliation. Under Palestine conditions, spraying should be effected in summer and early autumn at intervals of 10 to 18 days.

KUNKEL (L. O.). **Viruses in relation to the growth of plants.** —*Torreya*, xliii, 2, pp. 87–95, 9 figs., 1943.

In this paper, read at the 75th anniversary celebration of the Torrey Botanical Club in June, 1942, the author reports as new hosts of the cranberry false blossom virus tomato, *Vinca rosea*, *Calendula*, and *Nicotiana glutinosa*.

In all hosts the false blossom virus depresses growth in the plant as a whole, but stimulates the rate of growth in the flowers. In a number of plants to which it was taken it caused the production of giant blossoms. In tomato, the sepals of the diseased flowers were much larger than the sepals of normal flowers and instead of remaining separate fused into a sac-shaped structure, within which the petals were found to be green and borne at the end of a thick stalk about 1 in. long. In structure, the petals resembled leaves; some were simple, others compound. The anthers were generally small and green. In its effect on tomato flowers, the disease resembles big bud [*R.A.M.*, xxii, p. 457].

Apparently, several different strains of the false-blossom virus exist. From some diseased cranberries a strain was obtained that severely checked longitudinal, though it stimulated transverse, growth. Plants with this strain stopped producing flower buds soon after infection, and the growth of secondary shoots was not stimulated. From other cranberries a strain was obtained which stimulated longitudinal and checked transverse growth. This gave a spindling witches' broom type of growth. In tomatoes with the spindling strain no flower buds were produced except soon after infection. The flowers were not more than two or three times normal size. Other strains caused intermediate effects between the two extremes. The virus from most diseased cranberries caused the big-bud type of top in tomatoes, with large, malformed flowers and numerous secondary shoots. When the two extreme types were transmitted to periwinkle [*Vinca rosea*: ibid., xxi, p. 340] they caused similar variations in symptoms. When the common type of false-blossom virus was transmitted to *Calendula*, it caused the production of malformed green flowers. It also caused gigantism in *N. glutinosa*. In all the plants to which the false-blossom virus was taken it caused virescence and gigantism in flower or parts of flowers, chlorosis and dwarfing of leaves, and elongation or shortening of the internodes of the stems.

STEVENS (N. E.). **Cranberry false blossom in relation to flooding water.**—*Phytopathology*, xxxiv, 1, pp. 140–142, 1944.

Evidence in the form of field observations in Wisconsin over the past seven years is adduced in support of the opinion that freedom from false blossom in cranberries

[see preceding abstract] is correlated with the presence of alkaline flooding water (P_H 7·4 and upwards).

Dimond (A. E.) & Horsfall (J. G.). **Synergism as a tool in the conservation of fungicides.** *Phytopathology*, xxxiv, 1, pp. 136–139, 1944.

Some illustrations are given of the principle of synergism between different fungicides in connexion with the campaign for economy in the utilization of copper, the estimated consumption of which (as copper sulphate) in the United States during 1942 was 100,000,000 lb. For instance, in the synergistic system consisting of cuprous oxide and elemental sulphur, of which the former is toxic and the latter non-toxic to *Macrosporium* [*Stemphylium*] *sarciniforme*, the admixture of 30 per cent. of the latter with 70 per cent. of the former effects the maximum saving of copper, the total quantity of fungicide and dosage of cupric oxide required for 50 per cent. inhibition of spore germination being only 2·12 and 1·48 γ per sq. cm. compared with 5 and 5, 3·41 and 3·31, and 2·50 and 2·25 γ for the 100 : 0, 97 : 3, and 90 : 10 ratios of cuprous oxide to sulphur, respectively. In addition to laboratory tests, a field experiment was carried out to determine the value of cuprous oxide and sulphur mixtures in the control of tipburn, the results of which showed the optimum proportions for this purpose to be 75 : 25 and 90 : 10 per cent. The same combination was less effective against *Sclerotinia fructicola* and failed to protect celery from infection by *Septoria apii*.

In laboratory trials with mixtures of carbon disulphide and dimethyl amine, using *Sclerotinia fructicola* as the test fungus, the best results were secured with ratios of 50 : 50, 63·2 : 36·8, and 72·9 : 27·1, at which the relative dosage required for 50 per cent. inhibition of spore germination was 1·01, 1·00, and 1·06, respectively, compared with 660·00 at 100 : 0·0 and 61·50 at 0·0 : 100·0, respectively.

Other promising two-member systems include cuprous oxide with metallic oxides, e.g., zinc or lead, and either metallic oxides, mercaptobenzothiazole, or diphenyl amine with sulphur.

Glick (D. P.). **The deterioration of disinfectants in agricultural use.**—Abs. in *J. Bact.*, xlv, 1, pp. 42–43, 1943.

At the Colorado Agricultural Experiment Station, solutions of 0·2 per cent. mercuric chloride, 1 per cent. iodine, 2,000 p.p.m. chlorine, 2 per cent. cresol, and 5 per cent. phenol, which had been used for the continuous sterilization of rotary seed potato cutting knives to prevent the spread of *Phytomonas sepedonica* [*Corynebacterium sepedonicum*], were tested for their pathogenicity to *Escherichia* [*Bacterium*] *coli* in broth cultures. The organism withstood exposure to 1-gal. lots of the disinfectants after the cutting of 10, 8, 8, 24, and 12 100 lb.-sacks of potatoes, respectively. Moreover, field tests for the transmission of *C. sepedonicum* proved that the mercuric chloride, chlorine, and cresol solutions became ineffective after cutting 6, 6, and 18 sacks, respectively. The substitution of boiling water for the chemicals gave satisfactory results.

When a solution containing 180 p.p.m. available chlorine was used in a 2,000-gal. wash tank to control the spread of *Colletotrichum lagenarium* among honeydew melons before shipment, the chlorine content fell to 90 p.p.m. after the immersion of 35 tons in one day. A chlorine content of 400 p.p.m. fell to 200 following the washing of 70 tons of melons in one day.

Cox (A. J.). **Terminology of insecticides, fungicides and other economic poisons.**—*J. econ. Ent.*, xxxvi, 6, pp. 813–821, 1943.

The importance of the clear, precise, and adequate expression of technical language is emphasized and the use of misleading or ambiguous phraseology deprecated. The correct designation of insecticides, fungicides, and the like is not

only essential for the attainment of maximum results by manufacturers and users, but also of assistance to entomologists, plant pathologists, and chemists interested in advancing the knowledge of their work.

TERHORST (W. P.) & FELIX (E. L.). **2, 3-dichloro-1, 4-naphthoquinone ; a potent organic fungicide.** *Industr. Engng Chem.*, xxxv. 12, pp. 1255-1259, 5 figs., 1943.

The annual fungal damage to United States agriculture has been computed at $1,000,000,000, the yearly loss from raw cotton mildew alone being calculated at $25,000,000 to $75,000,000 (*Oil Paint Drug Rep.*, p. 41, 1st July, 1940). Among the many quinone-type chemicals that have been tested in the search for a potent and safe fungicide for use both in agriculture and the textile industry, 2, 3-dichloro-1, 4-naphthoquinone is outstanding, its efficiency in the control of 22 important fungi of widely divergent groups having been established. The compound is 4 per cent. soluble in xylene and ortho-dichlorobenzene, fairly soluble in dioxane, acetone, benzene, and diethyl ether, and slightly soluble in glacial acetic acid, ethyl alcohol, carbon tetrachloride, Skellysolve B, cellosolve, Stoddart solvent, gasoline [petrol], cod, cottonseed, and castor oils, and nujol; its solubility in water at P_H 7 is of the order of 1 to 10,000,000. The vapour concentration of 2, 3-dichloro-1, 4-naphthoquinone at 100° C. is 0·2 mg. per l.

In greenhouse tests at the General Laboratories, U.S. Rubber Company, Passaic, New Jersey, the maximum control (90 to 94 per cent. plant stand) of *Pythium ultimum* on peas under optimum conditions for disease development was secured by a dosage of the fungicide of 0·56 to 1·12 oz. per bush. seed, while for practical purposes a concentration of 0·28 oz., equivalent to $\frac{1}{32}$ per cent. by seed weight, sufficed. The average pea stand at the latter concentration in 12 experiments was 80 per cent., compared with 24 per cent. in the control plots, the corresponding mean heights of the plants at ten days being 5·97 and 4·67 cm., respectively, a highly significant difference. Excess dosages of 4·48 and 8·96 oz. per bush. did not injure the seed. The toxicity of 2, 3-dichloro-1, 4-naphthoquinone to *Ustilago* sp. in slide tests indicates a potential use against cereal smuts. Under the same conditions the compound completely prevents the germination of cotton anthracnose (*Glomerella gossypii*) spores at or below 1 p.p.m., while test tube cultures of treated and untreated cotton seed heavily infested by the pathogen showed a dosage of 6 oz. at a strength of 12·5 per cent. (0·75 oz. per bush.) to be completely toxic to the fungus when applied three months before planting. In greenhouse trials, 2, 3-dichloro-1, 4-naphthoquinone, applied just before planting, at the rate of 0·5 oz. active material per bush., appreciably reduced the incidence of *Rhizoctonia* [*Corticium solani*] and *G. gossypii*: at this concentration the stand from seeds infected by the former pathogen amounted to 60 per cent. compared with 0 for the untreated, the corresponding figures for the latter being 83 and 63, respectively.

Various articles of equipment of the armed forces require protection against mildew [*R.A.M.*, xxiii, p. 71], and 2, 3-dichloro-1, 4-naphthoquinone has proved highly effective for this purpose in laboratory and soil burial tests. In some of the latter, *Stachybotrys* spp. (probably *S. atra*, *S. papyrogena*, and *S. cylindrospora*) were destructive to cotton fabrics. Using the procedure of McCallan and collaborators, subsequently adopted by the Committee on Standardization of Fungicidal Tests, American Phytopathological Society [ibid., xxii, p. 489], the toxicity of the compound to *Metarrhizium* sp. and *S.* sp. was determined and the LD50 and LD95 values for the two organisms determined as 0·37 and 0·56 and 1·3 and 2·5 p.p.m., respectively. In fabric inoculation tests with *Chaetomium globosum*, 2, 3-dichloro-1, 4-naphthoquinone entirely prevented the development of the mould on impregnated duck. The quinone, which exerts no adverse effects on the strength of the treated fabrics, may be applied in any of four ways, viz., in an organic solvent (0·1 per cent.

for light cotton sheeting, 0·5 to 1 per cent. for heavier materials); in aqueous suspensions of P_H 4 to 5, containing 20 per cent. active chemical and the necessary protective agents; in a lacquer (for wood, rubber, and the like); or by one hour's exposure to vapour at 125° C.

Marsh (P. B.), Greathouse (G. A.), Rollenbacher (Katharina), & Butler (Mary L.). **Copper soaps as rot-proofing agents on fabrics.**—*Industr. Engng Chem.*, xxxvi, 2, pp. 176–181, 2 figs., 1944.

Of the four copper-containing soaps, viz., copper naphthenate (8 per cent. copper), copper oleate (10 per cent.), copper tallate (7 per cent.), and copper hydrogenated resinate (6 per cent.) tested for the prevention of fungal rotting of cotton duck fabrics [see preceding abstract], the first-named alone suppressed the growth of the copper-tolerant *Aspergillus niger*, which was inhibited on the glucose- and peptone-containing three-salt medium of Greathouse *et al.* [*R.A.M.*, xxii, p. 73] in the presence of 0·2, 0·4, or 0·8 per cent. of copper naphthenate, while continuing to develop at these levels in that of the other compounds. The high preservative value of copper naphthenate is attributed to the fact that its organic acid radical, naphthenic acid, effectively inhibits the growth of *A. niger*, *Penicillium* sp., *Chaetomium globosum*, and *Metarrhizium* sp., and protects the fabric against deterioration in the soil. No such action was exerted by tall oil, oleic acid, or hydrogenated resin. Copper naphthenate drastically leached with dilute nitric acid until essentially free of copper retained sufficient residual potency to prevent the growth of *A. niger* and to protect the fabric from deterioration in the soil.

Fabrics impregnated with copper oleate, copper naphthenate, and copper tallate lose copper readily at the points of contact between the material and the soil. Each of these compounds is insoluble in water, but may be rendered soluble by acid hydrolysis or by reaction with materials forming soluble copper complexes. Thus, a neutralized sodium hydroxide extract of soils will bring copper soaps into solution, while neutralized solutions of a variety of naturally occurring hydroxy and amino acids, e.g., gallic, aspartic, glutamic, and gluconic, act in a similar manner. Copper hydrogenated resinate, on the other hand, is highly resistant to leaching under comparable conditions, its relatively poor protective power in contact with soils being perhaps partly due to the low availability of ionic copper.

The relative superiority of copper naphthenate to the other three copper soaps under investigation was accentuated in comparative tests by soil factors tending to minimize the preservative value of the copper, i.e., leaching, adsorption, and chemical deactivation.

Gershenfeld (L.). **Ultraviolet light as a sanitary aid.**—*Rep. Smithson Instn, 1942*, pp. 209–225, 1943.

After referring to the susceptibility of micro-organisms to ultra-violet radiation, the author discusses the production of such radiation by means of lamps and the use of ultra-violet light as a practical sanitary aid. An important section of the paper is devoted to this form of sanitation as applied to the meat, baking, and dairy industries and to various foods and beverages [*R.A.M.*, xix, p. 159]. Ultra-violet light properly used on meat in large walk-in refrigerators, refrigerated freight cars, small coolers, and refrigerated display cabinets gives an all-round better and more sanitary product than is possible without it. By reducing mould and bacterial growths, it saves trimming the meat, and washing and cleaning its surfaces. The Tenderay process, developed at the Mellon Institute, utilizes ultra-violet light for inhibiting mould and bacterial growth as an essential part of its operation.

Many large bakeries use ultra-violet radiation throughout the entire processing, especially from the moment the products leave the oven until they are 'packaged'. Conveying, cooling, slicing, and wrapping are carried out under irradiation, which

frees even the wrapping material from contamination by yeasts, moulds, and bacteria. Not only are the air and the equipment continuously irradiated, but the destruction of yeasts and moulds on nuts, raisins, and other ingredients is also effected by radiation. Treatment has greatly improved the keeping qualities of these products, even after they reach the consumer.

The process is being increasingly used in dairying, in poultry houses and incubator rooms, and in preserve-making and the preparation of bottled drinks.

PITMAN (G. A.). **Mold count recording device.**—*J. Ass. off. agric. Chem., Wash.*, xxvi, 4, pp. 511–513, 2 figs., 1943.

The official method for the determination of mould in tomato products specifies examination with a microscope at about 100 diameters magnification of 25 fields on each of two or more Howard slides, the fields being spotted within a 19 mm. circle. Heretofore, the data have been recorded by any system approved by the analyst or group concerned, but all such methods have necessitated shifting the eyes from the microscope to permit manual notation of the presence or absence of mould hyphae, and the consequent repeated refocusing and reaccommodation involves a great strain on the sight. To obviate this source of fatigue, a contrivance has been devised, and is here fully described, whereby a piece of paper fastened to the mechanical stage and moving with the slide can be marked automatically as each positive field is encountered. A legible record is thus provided of the number and relative positions of the contaminated fields without removing the eyes from the microscope.

MCKEE (CLARA M.), RAKE (G.), & HOUCK (CAROL L.). **Studies on Aspergillus flavus. II. The production and properties of a penicillin-like substance—flavacidin.**—*J. Bact.*, xlvii, 2, pp. 187–197, 1 graph, 1944.

Under certain conditions, notably in the form of submerged growth in a modified Czapek-Dox medium with agitation and aeration, the mould *Aspergillus flavus* produces a substance designated flavacidin, which resembles penicillin in the following characteristics: (*a*) both are highly active against Gram-positive organisms and relatively non-toxic to those of the Gram-negative group; (*b*) both protect mice in an equal degree against *Pneumococcus* infection; (*c*) both are highly soluble and hence readily absorbed after parenteral inoculation and rapidly excreted by the kidneys; (*d*) cultures resistant to the action of penicillin react similarly to flavacidin but not to other antibiotic substances; and (*e*) an enzyme active against penicillin affects flavacidin, but not other antibiotic substances, in a similar manner.

WAKSMAN (S. A.). **Purification and antibacterial activity of fumigacin and clavacin.**—*Science*, N.S., xcix, 2568, pp. 220–221, 1944.

This is a brief summary of the results thus far obtained in the study of the antibacterial substances fumigacin and clavacin [*R.A.M.*, xxii, p. 267; xxiii, p. 156]. It is considered that helvolic acid, recently isolated from a strain of *Aspergillus fumigatus* by E. Chain *et al.* (*Brit. J. exp. Path.*, 24, pp. 108–119, 1943) [and next abstract] is identical with fumigacin; and that patulin, claviformin, clavatin, crystalline clavacin, and crude clavacin are all identical in their chemical nature and antibacterial activity. It appears to be thus established that *A. clavatus*, *Penicillium claviforme*, and *P. patulum* produce the same antibiotic substance. Many organisms are capable of producing more than one type of substance and *A. fumigatus* forms four: spinulosin, fumigatin, fumigacin, and gliotoxin, the first two of which are closely related.

Menzel (A. E. O.), Wintersteiner (O.), & Hoogerheide (J. C.). **The isolation of gliotoxin and fumigacin from culture filtrates of Aspergillus fumigatus.**—*J. biol. Chem.*, cliii. 2, pp. 419–429, 1944.

Aspergillus fumigatus, grown on the Czapek-Dox medium, produces simultaneously two antibiotic agents, gliotoxin and fumigacin, of which the former accounts for the greater part of the antibiotic activity. In studies at the Squibb Institute for Medical Research, New Brunswick, on the production of the two compounds under various conditions, it was demonstrated that the crystalline material previously described as fumigacin [*R.A.M.*, xxii. p. 267] is a mixture of that substance and gliotoxin [ibid., xxi. p. 216]. In respect of its chemical and bacteriological properties, pure fumigacin appears to be identical with the helvolic acid recently isolated by Chain *et al.* from the same source [see preceding abstract].

Blackwell (Elizabeth). **Species of Phytophthora as water moulds.**—*Nature, Lond.*, cliii, 3886, p. 496, 1 fig., 1944.

The author states that parasitic species of *Phytophthora* may masquerade as saprophytic water moulds for long periods of time until they are carried by water to fields where they may attack crops. She asks for the collaboration of mycologists in determining the distribution of *Phytophthora* in British streams, ponds, and ditches and gives directions with regard to the method of collection, type of bait and container, and treatment, identification, and transport of the collected material.

Ryan (F. J.), Beadle (G. W.), & Tatum (E. L.). **The tube method of measuring the growth rate of Neurospora.**—*Amer. J. Bot.*, xxx, 10, pp. 784–799, 1 fig., 6 graphs, 1943.

The authors describe the following technique for studying the growth of *Neurospora* spp. (mainly *N. crassa* and *N. sitophila*) in culture; the method is also considered suitable for bio-assay work. Horizontally fixed glass tubes (40 cm. long with an internal bore of about 13 mm.), both the open ends of which are bent up at an angle of 45°, are half-filled with a standard solid medium, the openings then stoppered with cotton, and tubes and media autoclaved for 10 to 15 mins. at 15 lb. pressure. On cooling, the media are inoculated by introducing conidia or mycelia into the tubes at one end only, and the position of the advancing mycelial frontier is measured at convenient time intervals by marking the tube. Later these measurements are plotted against time, and the rates of growth determined from the linear positions of the curves. The standard deviation of the rate of growth in the tube method is 3·6 per cent. of the mean. It was found that factors influencing the rate of growth of *Neurospora*, and which should be held constant, are composition and concentration of salts in the medium, carbon and nitrogen sources, trace elements, purity and concentration of agar, hydrogen-ion concentration, temperature, and the depth of the medium in the tubes; on the other hand, factors having little or no effect are tube size, gas diffusion, light, humidity, nature of inoculum, and presence of vitamins or amino acids. Standard conditions selected on the basis of these findings are described.

Marchionatto (J. B.). **La obra fitopatológica de L. Hauman en la Argentina.** [The phytopathological work of L. Hauman in Argentina.]—*Rev. Fac. Agron., B. Aires*, x. 3, pp. 363–369, 1943 (issued 1944). [English and Portuguese summaries.]

This is a commentary on the phytopathological studies carried out by L. Hauman during his tenure of the Chair of Botany at the College of Agriculture, Buenos Aires, from 1904 to 1925, among those referred to being the revised list (prepared

in collaboration with L. Parodi) of vegetable parasites of cultivated plants in Argentina [*R.A.M.*, i, p. 182].

PADWICK (G. W.). **Some problems of control of soil-borne fungal diseases in plants.** —*Anniv. Vol. R. bot. Gdn, Calcutta, 1942*, pp. 213–220, 1942.

Following a review of some important contributions to the knowledge of antagonism between fungi in relation to the control of soil-borne plant diseases, the writer discusses illustrations from his experience of the complexity of the root-invading microflora.

The first example concerns *Ophiobolus graminis*, typical lesions of which on wheat roots yielded numerous cultures of *Fusarium avenaceum*. In an experiment to determine the possibility of joint invasion by the two organisms, wheat was sown in sterilized soil in pots; in the same heavily inoculated with *O. graminis*; in the same after immersion of the seed in a spore suspension of *F. avenaceum*; and in a fourth series, sterilized soil was inoculated with *O. graminis* and planted with seed infected by *F. avenaceum*. In the first lot, the seedlings were healthy; in the second, the entire root system was rotted, the stems blackened to an inch or so above soil-level, and the plants severely stunted; in the third, the seedlings were slightly stunted and the stems and roots bore well-defined, reddish-brown lesions; and in the fourth, the plants, though significantly more dwarfed than those attacked by *O. graminis* alone, showed the external symptoms of the latter fungus only. Isolations from the surface-sterilized stem tissues of plants inoculated with *O. graminis* alone yielded only *O. graminis*, and those with *F. avenaceum* alone only *F. avenaceum*: on the other hand, the plants jointly inoculated with the two fungi and manifesting only the features of *O. graminis* uniformly gave rise to *F. avenaceum*, with no trace of the agent of the major disease.

In the second case, the author and N. Prasad isolated from gram (*Cicer arietinum*) stems an extremely varied collection of *F.* spp., some of which were experimentally proved to be capable of causing seed decay, while others were responsible for wilting. The publication of this work is expected shortly.

In the third instance, isolations were made from the stipules, stems, leaves, and roots of 'foot-rotted' *Piper betle* plants from six gardens in the State of Chhatarpur, 25 of *F.* and 10 of *Colletotrichum* being obtained from 40 pieces of stipule tissue, while the corresponding numbers for 30 pieces of stem, 10 of leaf, and 30 of root tissue were 7 and 19, 1 and 4, and 17 and 1, respectively; the leaves further yielded two unidentified fungi and the roots one. Neither *Phytophthora* nor *Rhizoctonia* was isolated, though the former was observed in some of the leaf sections. These observations suggest that a fungal complex may be implicated in the etiology of the disease.

Various general deductions are drawn from these and other similar cases.

BERKELEY (G. H.). **Root-rots of certain non-cereal crops.**—*Bot. Rev.*, x, 2, pp. 67–123, 1944.

After a brief introduction, the author reviews the literature on the root rots of woody perennials, tobacco, cotton, sugar beet, peas, vetches, clovers, sugar-cane, maize, pineapple, flax, soy-bean, broad bean, ginseng, strawberries, raspberries, vegetables, and herbaceous ornamentals, and then discusses the relation of temperature, soil reaction, and humidity to that group of diseases, and their control by means of resistant varieties, crop rotation, biological agents, fertilization, soil disinfection, organic manures, ringing, felling, and barriers. Concluding sections are devoted to types of root rot and trends in research. A bibliography of 347 titles is appended.

Agricultural education in Victoria. Report of the Victorian Branch.—*J. Aust. Inst. agric. Sci.*, ix, 4, pp. 141–153, 1943.

In this report on post-war agricultural education by the Victorian branch of the Australian Institute of Agricultural Science, the organization of the State extension service and agricultural training are discussed in some detail. *Inter alia*, it recommends that a Division of Publicity should be established, with a staff that includes graduates in agricultural science with experience in journalism.

CURTIS (L. C.). **Deleterious effects of guttated fluids on foliage.**—*Amer. J. Bot.*, xxx, 10, pp. 778–781, 4 figs., 1943.

Observations in the field and greenhouse showed that three things may happen to the guttation drop on a plant: (1) it may roll off, (2) it may evaporate, or (3), as most frequently happens on undisturbed plants, it may be sucked back into the leaf. When neutral red crystals were placed in the guttation drop of maize and squash (*Cucurbita maxima*) plants, the drop was sucked back into the leaf and the vascular system of such a leaf was stained for a distance of one to three inches.

On the basis of these observations, an hypothesis is advanced to explain some of the common types of tip burn found in many economic and ornamental plants. When the guttation water evaporates on the tips of the leaves, there remain various salt deposits which may increase due to a continuous guttation process over a one-, two-, or even three-day period. These deposits may affect the leaf in two ways. Because of their high salt concentration they may remain and damage the outside of the leaf in the same way that fertilizer does when it is put on leaf blades, or they may dissolve in subsequent guttation water and be sucked back into the leaf, where the hypertonic solution kills the cells. Changes in the guttation fluid, which are toxic to the internal cells, may be produced by bacteria, moulds, or enzymes. The hypothesis also explains how non-motile bacteria and chemical substances applied to the leaf as fungicides may enter the leaf.

BJÖRKMAN (E.). **The effect of strangulation on the formation of mycorrhiza in Pine.**—*Svensk bot. Tidskr.*, xxxviii, 1, pp. 1–14, 9 figs., 1 graph, 1944.

In three-year-old potted pine plants constricted on 5th May, 1943, by means of thin iron wire 5 cm. above ground-level, mycorrhizal formation was almost completely inhibited during the subsequent growing period. After the performance of the operation, the amount of soluble carbohydrates in the roots dwindled to insignificant proportions in comparison with that in the controls because of the interruption in the supply to the roots of the products of photosynthesis. The author's hypothesis that mycorrhizal formation is largely conditioned by an excess of soluble carbohydrates in the roots (*Symb. bot. upsaliens.*, vi, 2, 1942) was thus confirmed. The mycorrhizal fungi did not assume a strictly parasitic mode of existence when the root system of the pines became debilitated through the constriction of the stems. On the contrary, they ceased to attack the roots lacking in carbohydrates, just as in the case of plants receiving insufficient light, whereas the unconstricted controls, with their well-developed root systems, were enveloped in copious mycorrhizal mantles. Mycorrhiza, therefore, may be regarded as parasites on their hosts in respect of energy, but not as parasites in the usual sense of the word; they do not injure the host. The facts recorded in this paper correspond very well with the inability of mycorrhizal fungi to utilize such sources of carbon as cellulose, starch, and even saccharose. According to Melin [*R.A.M.*, v, p. 245] and Norkrans (*Svensk. bot. Tidskr.*, xxxviii, 1944), mycorrhizal fungi are unable to utilize any carbon sources other than readily soluble carbohydrates, especially glucose. Nothing in the outcome of these experiments, in short, contradicts the notion of mycorrhizal symbiosis as a process of value to the host.

Potatoes.—*Bull. Me agric. Exp. Sta.* 420, pp. 419–482, 4 figs., 1943.

R. Bonde states that much progress has been made in the improvement of potato seed stocks in Maine as regards freedom from ring rot [*Corynebacterium sepedonicum*: *R.A.M.*, xxiii, p. 118], no complaint having been received regarding 18,000 truckloads of certified seed recently exported to other States.

In studies by R. Bonde and S. Snieszko it is stated that a seed stock with an occasional diseased tuber will usually show 1 per cent. ring rot at harvest, and 10 or 15 per cent. rot or even more when planted successively for two or three years.

During 1942, some 3,500 seedling potato varieties were tested for resistance to ring rot, and two foreign varieties and four potato seedlings were found to be resistant.

Tissue extracts of different potato varieties after passage through bacteriological filters showed striking differences in their ability to support growth of *C. sepedonicum*. Snieszko found that the addition of sodium dichromate (1 : 20,000) [to the media] made it possible to isolate the ring-rot organism from rotted tubers with advanced secondary decay. Skim milk with added litmus was used as a medium in which the stock cultures of *C. sepedonicum* remained viable for months. Preliminary tests indicated that the ring-rot organism forms a uniform serological group, and that the agglutination test may be used to identify this bacterium. This may mean that a resistant variety is resistant to the disease whatever the source of the organism. In preliminary experiments on the survival of *C. sepedonicum* under various conditions the organism survived for several months on bags made of cotton or jute but died off in a comparatively short time on wooden toothpicks [cf. ibid., xxiii, p. 38].

In test-tube experiments by Snieszko the growth of *C. sepedonicum* was completely suppressed by crystal violet (1 : 1,000,000), brilliant green (1 : 100,000), fuchsin (1 : 100,000), trypan blue (1: 5,000), coal tar disinfectant (1 : 10,000 to 1 : 50,000), semesan bel (1 : 1,000 to 1 : 5,000), mercuric chloride (1 : 10,000), cupric sulphate (1 : 1,000 to 1 : 5,000), phenol (1 : 1,000), 4-tertiary-butyl-metacresol (Kopper's) (1 : 5,000 to 1 : 10,000), U.S. rubber germicide No. 83 (1 : 5,000), and U.S. rubber germicide No. 590 (1 : 1,000).

Some of the newer potato varieties, such as Katahdin, Chippewa, and Houma are susceptible to leaf roll but do not develop net necrosis in the tubers. These varieties may be considered to be resistant to leaf roll to this extent, but it is quite possible that varieties with greater resistance may be developed. Other methods include aphid control, isolated seed plots, roguing, and early harvesting. D. Folsom states that several thousand seedlings have been tested for resistance to leaf roll over a number of years. During the 1941 growing season at Highmoor Farm, 79 per cent. of the Green Mountain potatoes, 91 per cent. of the Chippewa, and 85 per cent. of the seedling varieties contracted the disease.

D. Folsom and M. Goven found that samples from fields which apparently had considerable leaf roll showed much net necrosis even at storage temperatures of 31° to 36° F. Potatoes from one field had 36·2 per cent. net necrosis when stored at 53°, and only 15·3 per cent. when stored at 31°, while the figure was 20 per cent. at 36°. Potatoes from another field showed 0·7 per cent. net necrosis at 36° and 15 per cent. at 53°. When potatoes were kept at about 70° for 60 days, and the storage temperature was then reduced to about 51°, much less net necrosis developed than was the case when other samples from the same lots were held continuously at 51°.

A. F. Ross and M. T. Hilborn state that Green Mountain potatoes stored at 32° did not develop mahogany browning [ibid., xxii, p. 221]. Chippewa potatoes with leaf roll usually showed a more severe discoloration in the cortex than else-

where in the tuber, while healthy Chippewa generally displayed the discoloration only in the vascular ring and pith. In most instances, the pith was the most severely affected part, the discoloration appearing as scattered spots. There was a difference of six or seven weeks in the time taken for the symptoms to appear as between tubers grown at Highmoor Farm and those grown in Aroostook County, but before the end of the storage period the percentage of affected tubers was about the same from all sources.

R. Bonde and G. W. Simpson report that leaf roll and net necrosis are often limiting factors in the production of Green Mountain potatoes for market. The presence of a relatively small amount of net necrosis in table stock potatoes puts them out of U.S. 1 grade, while buyers expect seed potatoes to be relatively free from leaf roll and net necrosis. In 1940, the ratio of net necrosis to leaf roll in Green Mountain potatoes was found in one test to be 1 : 4·51, while in 1941, it was 1 : 2·82.

D. Folsom and M. Goven found that the incidence of stem-end browning [ibid., xxi, p. 322; xxii, p. 221] varies from one field to another. In storage at 52°, potatoes from two fields showed 40 and 6 per cent. stem-end browning, respectively. Scarcely any was found at digging time in four fields under observation, the soil temperature being (at digging) rather below the optimum for the condition. In storage at 36° samples from four fields 90 days after digging showed, respectively, 1·7, 1·6, 1·5, and 0·4 per cent. stem-end browning, while other samples from the same fields, but stored at 51° to 53° had, respectively, 21·7, 39·5, 6·4, and 15·9 per cent. Other lots from the same fields kept for 60 days at 70° and then for 30 days at 50° to 51° had, respectively, 1, 0·9, 2·1, and 1·8 per cent. stem-end browning; yet others from the same fields held at 53° to 55° for 30 days had, respectively, 8·2, 23·3, 4·8, and 5·1 per cent., as against 21·7, 39·5, 6·4, and 15·9 per cent. for lots kept at 51° to 53° for 90 days.

Experiments in 1941 by R. Bonde and H. R. Shepherd indicated that the concentration of Bordeaux mixture may be reduced from 10–5–100 to 8–4–100 with no significant diminution in yield or blight control. In 1942, Bordeaux mixture 4–2–100 applied with a tractor spray did not control infection when the weather conditions favoured the disease and the source of infection was heavy and close at hand; this low concentration did, however, give moderately good control in plots remote from a heavy source of infection. The yield per acre was not reduced when the 4–2–100 formula was used. It would seem that many growers who use tractor-power spray machines are applying much more Bordeaux mixture than is necessary or advisable. When a horse-drawn wheel-traction outfit was employed, which supplied 90 gals. of spray per acre, as compared with 140 gals. from the tractor-power machine, all the formulae used (10–5–100, 8–4–100, 6–3–100, and 4–2–100) gave satisfactory control, the best results being given by the 10–5–100 treatment (protective coefficient, 1). At 8–4–100, the protective coefficient was reduced to 0·9, at 6–3–100 it was 0·83, and at 4–2–100 it was 0·62. The plots sprayed with 10–5–100 gave 30 bush. per acre more potatoes than those sprayed with 8–4–100. The other reduced concentrations gave corresponding reductions in yield. It is concluded that the copper content of Bordeaux mixture used for spraying potatoes can be materially reduced if a tractor-power machine is used.

R. Bonde and S. Snieszko state that purple top [loc. cit.] is not caused by a species of *Rhizoctonia*. The seed tubers from affected plants either fail to grow or produce only small fine sprouts and plants. Two helpful methods of reducing losses are (1) to rogue all affected plants, and (2) to allow the seed stock to sprout slightly and discard the tubers that produce weak sprouts.

E. R. Tobey, B. E. Plummer, and R. Bonde state that white distilled vinegar satisfactorily maintained the mercuric chloride strength of dipping solutions used to disinfect seed potatoes.